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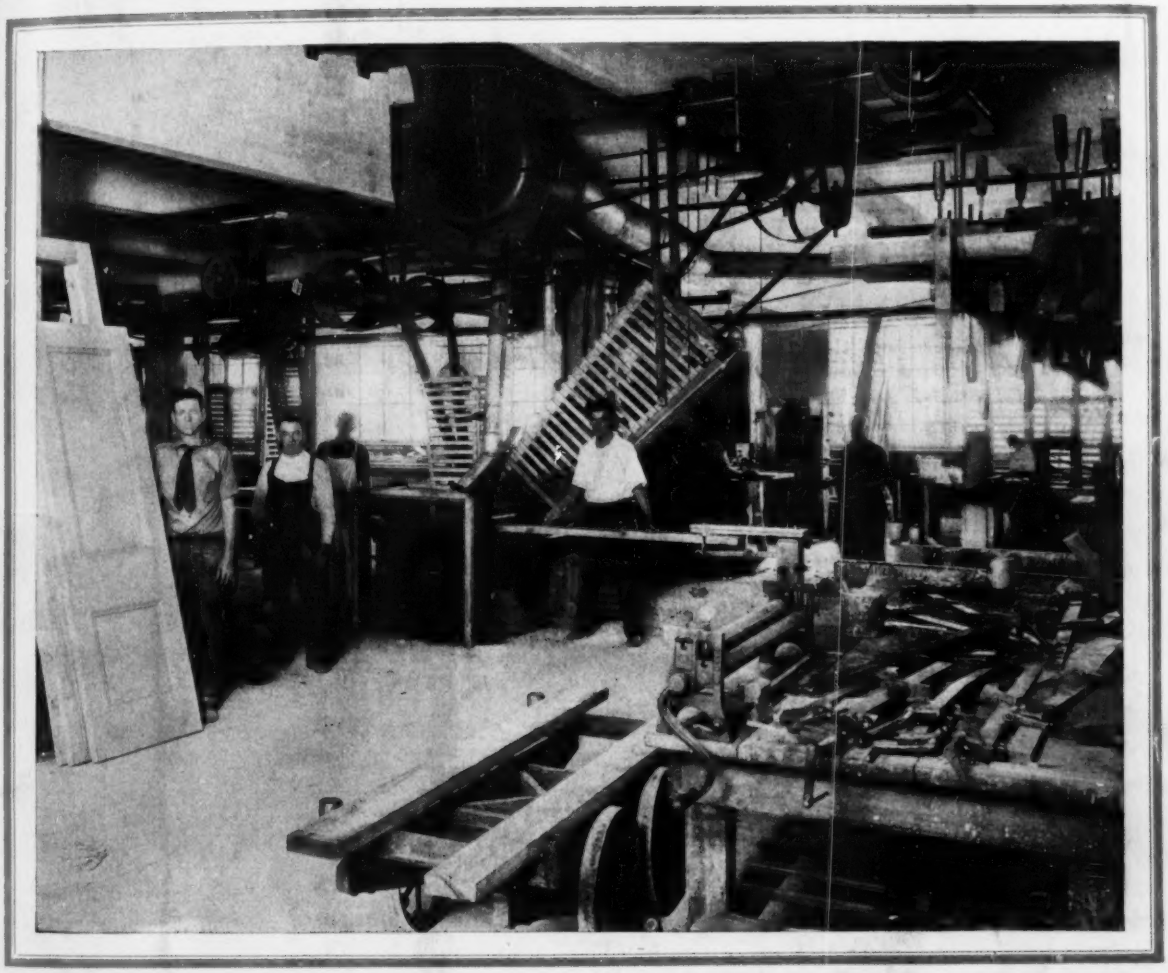

Increased size of construction operations is creating a new type of industrial plant—the contractor's service plant. Equipment storage and repair have come to be major considerations of a construction firm. In an article in this issue the ramifications of such a plant are fully described. The cover illustration, showing but a small corner of this large installation, depicts operations in the wood mill.

The Full Story is Told in

Contractor's Service and Repair Plant

Other articles in this issue include:

U. S. Supreme Court Restricts Chicago Drainage District Diversion

Heavy Foundations on Sand-Rock, Nebraska State Capitol

Staff Report of American Road Builders' Convention

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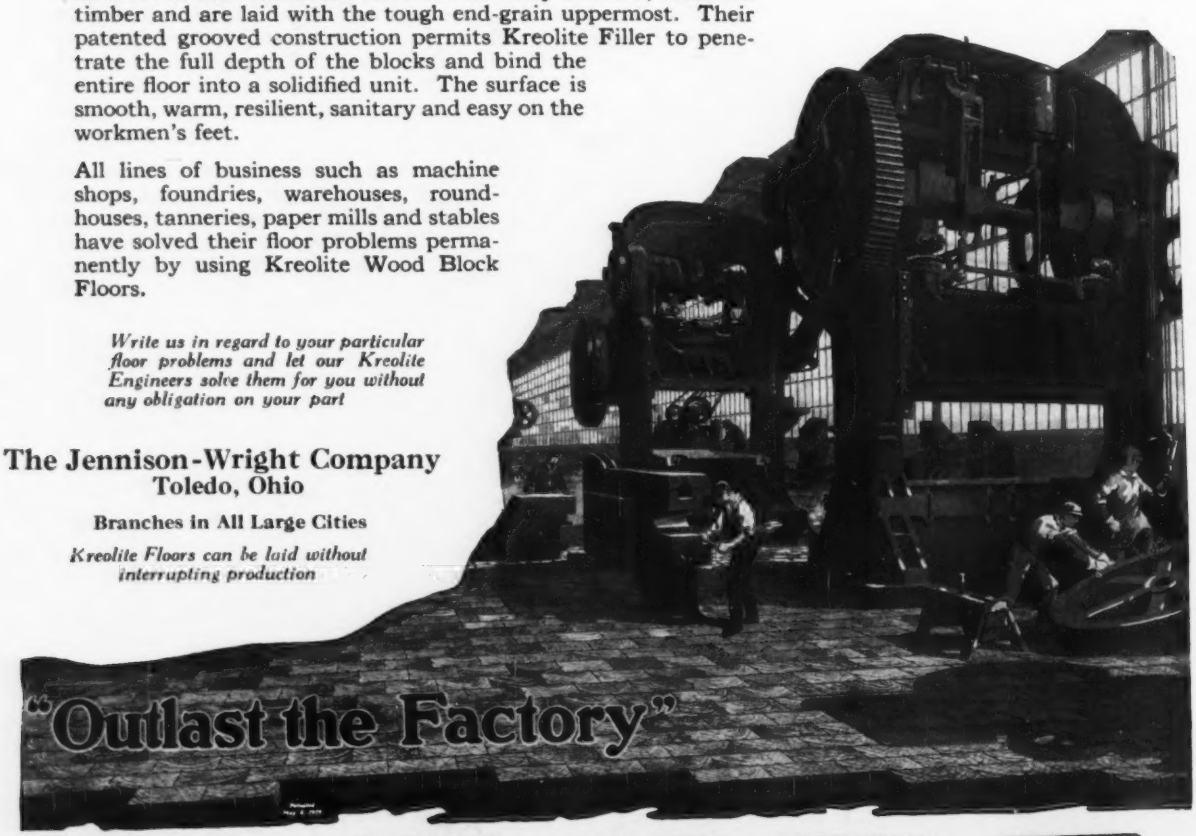

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ENGINEERING NEWS-RECORD

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DEVOTED TO CIVIL ENGINEERING AND CONTRACTING

FRANK C. WIGHT
Editor

Volume 94 NEW YORK, JANUARY 15, 1925 Number 3

An Engineer for City Commissioner

COMMENDABLE both as a recognition of good work done for a city in one capacity and as a determination to sink factional interests in those of the city as a whole is the movement now on foot at New Orleans to make City Engineer Klorer one of the city commissioners or councilmen at the coming city election. To that end two of the local "factions"—there is but one "party" in New Orleans—have united to back Mr. Klorer and hope has been expressed that the third "faction" would also do so. In view of the fact that one of the great weaknesses of the plain commission plan of city government lies in entrusting to popular vote the choice of persons who by virtue of their election as councilmen are to become heads of important city departments, New Orleans will be fortunate in the election of Mr. Klorer, for it is tacitly understood that if elected, as seems assured, he will be made commissioner of public property. His experience as city engineer makes him a logical choice for that position.

An Impetus to Reforestation

WITH the passage and putting in force during 1924 of the Clarke-McNary reforestation act, the United States has taken official notice of the necessity for widespread and systematic safeguarding of standing timber and the practical utilization of forest products. By the act more adequate fire protection is assured, taxation is revised to stimulate private reforestation, reforestation is greatly aided if not popularized through creation of farm wood lots, and research looking toward more economic use of timber products is quickened. The act supplements efforts toward these ends that states and private concerns have made in the past, and enlarges, under the Secretary of Agriculture, federal forest activities. Spokesmen for the lumber industry and the federal government hail the Clarke-McNary act as the greatest advance in forestry since the enactment of legislation in 1911 which committed the government to an active policy of acquisition of forest lands through creation of adequate preserves. The engineer's interest in this impetus given forestry is obvious, and he may be expected to assist materially in making more certain the perpetual availability of this important structural material.

Financing a Golden Gate Bridge

SAN FRANCISCO has been advised that the War Department has no objection to the construction of the Golden Gate Bridge. The government stipulates that it must be reimbursed for the cost of such rearrangement of adjacent fortification works as the bridge may make necessary and adds certain demands of a somewhat Shylockian nature, but generally speaking, it is willing that this project shall be carried out. It now remains for San Francisco and the other communities interested to decide whether the traffic over a toll bridge will justify the venture and whether it can be financed. The financial question is the real crux of the whole matter. The estimate of $27,000,000 as the total cost of a bridge that would have a central span of 4,000 ft. is believed by some capable engineers to be only a fraction of the true cost. There are, therefore, two leading questions which must be decided before the matter can take definite shape: (1) What is a fair estimate of the total cost and (2) can the necessary money be raised. Since the answer to the second question hinges on the answer to the first, attention is focused on detailed plans and a statement of proposed construction methods, neither of which have thus far appeared.

Joint Sanitary Districts

IN UNION there is often much more than the strength of mere numbers. This is notably true of the joint sanitary districts that are growing in numbers and importance in both America and Europe. There is all the more strength when one of these districts takes in a whole natural drainage area and includes not only sewerage, as was once generally the case, but water supply control as well. These advantages are strikingly illustrated in the article by Karl Imhoff, elsewhere in this issue, dealing with the Emscher and Ruhr districts in Germany. It is one of these exigent water-supply problems which have led to most interesting developments in both sewage treatment and water supply, including for the latter the provision of special filter and feeder channels to reinforce the infiltration basins. Water storage and power are also a feature of the works described by Dr. Imhoff.

Two Hundred Fifty Million Dollars

WITH a frankness that is as rare as it is bold Governor Smith has put the case of the New York Barge Canal before the people of that state. Up to now it has been little short of treason for a state official to suggest the possible unwisdom of that expensive experiment; certainly to do so would have been seized upon by the waterway enthusiasts as direct evidence of malign intent to harm this sacred piece of construction. But the governor has dared this criticism and has stated some plain facts. The cost to date of the public work for which the people in 1901 were asked to authorize $101,000,000 is upwards of $230,000,000, and the annual cost, *not* including interest and amortization, is from three to four million. For this enormous sum there is carried along the canal some 2,000,000 tons of freight which costs the state alone about 2c. a ton-mile, in addition to what it costs the carriers, and which could have been carried by the railroads for about half of what it cost the state alone. Meanwhile the

canal is not finished, structural maintenance is beginning to be an item, and there are damage claims amounting to about twenty millions. What is New York going to do with this white elephant? The governor doesn't know, any more than his predecessors, but he wants a commission to help him find out. Such a commission may discover some new facts and if it can it will be performing a worthy service, for as the case now stands the New York State Barge Canal is a colossal failure. There is too much agitation in the country for similar waterways to leave any stone unturned to find out whether or not the Barge Canal will do what has been claimed for it.

Why Clear All the Sidewalk?

SNOW removal in our cities is hampered and the resulting congestion of traffic following a snowstorm is increased by the antiquated laws or ordinances that require that all sidewalks shall be completely cleared within a reasonable time after snow stops falling. The property owner is under compulsion to get rid of this snow and the only place he can put it is the street. In consequence we have ten to twenty-five foot sidewalks smooth and clean as a ballroom floor and piles of snow man-high cumbering the gutters and the curbside lanes of the streets. Vehicle traffic is restricted to the narrow center lanes and delayed by the snow removal forces working at the mountains piled up from the sidewalk cleaning, while a broad sidewalk is left clear for a pedestrian traffic which could be readily accommodated in half the normal sidewalk width. The laws or practices that continue such an evil should be changed. Someone should be given authority to rule whether sidewalk or street in specific locations is the more important artery and in every street but those crowded downtown districts the sidewalk cleared space should be narrowed and the curbside sidewalk space left for snow cleared from both street and sidewalk.

Railroad Valuation Reform

ONE HUNDRED MILLION dollars and ten years of work have been spent on the valuation of the railroads of this country, yet to date a final value has been fixed on only 8,000 miles out of the total of 250,000. The Interstate Commerce Commission, in its annual report, draws attention to this fact and estimates that it will have to hear 500 more protests, many of which will run into thousands of pages of testimony and exhibits, before the work is completed. Many of the points at issue in these protests are of minor importance, but in the slow processes of legal procedure they take up a great deal of time, delay the whole work of valuation, and frequently cost more than the items in question are worth. In order to eliminate as many of such points as possible the commission has established a system of conferences between its engineers and those of the railroads to take place before the hearing on the tentative valuation of each railroad. At these conferences many of the points at issue are discussed and frequently a compromise is reached which eliminates them from the formal hearing. This procedure has already done much to speed up the formal hearings, but the gains made in this way are being offset by forced reductions in the staff of the Interstate Commerce Commission due to reductions in appropriations for its work.

But even with this advance in the method of establishing the final value of the railroad properties, there is still too much bickering over technicalities at the hearings. Terms and requirements were written into the Valuation Act that have become stumbling blocks to the whole procedure. "Original cost," "cost of reproduction new," "cost of reproduction new less depreciation," "final single-sum value," and "value for rate-making purposes" are terms which have already filled volumes. Now that government ownership seems to have been definitely rejected, the importance of some of these terms which the proponents of the Valuation Act had written into it has disappeared. The principal thing that is needed now is a value for rate-making purposes. If the others could be eliminated, much of the work now still in prospect would become unnecessary, and the real work would be expedited.

For instance, the failure of the commission to find an original cost—an obviously impossible feat for most of the older railroads—has received much attention by lawyers pleading against tentative valuations, and whole valuations have been declared by them illegal because the commission has failed to report the original cost. Such cost figures are relatively unimportant and yet as long as they remain in the Valuation Act they will be a source of much lost time and lost money. Surely, it should be possible for the Interstate Commerce Commission to recommend to Congress some legislation which would simplify the proceedings and thus make it unnecessary to add many more millions to the hundred already spent only to find in the end that the cost of coming to an agreement on some of these figures of doubtful value has far exceeded any possible benefit that could be derived therefrom.

In order to conform with current views on the regulation of public utilities, some approximate value should be assigned to the railroad properties, but with the present cost of new facilities, of new equipment, and of replacing old structures the value of what was spent previous to 1914 becomes less and less important each year in relation to the whole value of the railroad property. Consequently the necessity for keeping a proper record of recent expenditures and of seeing that they are charged to the proper accounts should not be lost sight of while arguing over what was spent in the days before such records were kept. This is bound to occur unless the commission is provided with an adequate staff to carry on this work independent of the work of evaluating the existing property, or else is relieved of much of the work now before it.

Municipal Employees and the Income Tax

THOUSANDS of municipal employees who have hitherto considered themselves exempt from federal income taxes will have to file returns for the past six years and pay taxes proportionate to their incomes from municipalities if the solicitor's opinion printed on p. 106 is uncontested or unsuccessfully fought in the courts. The opinion is based on the legalistic ground that a city running a water-works or any other service of a proprietary character does it in a private or non-governmental capacity.

This was the basis of much of the opinion in the Metcalf & Eddy excess profits income tax case (see *Engineering News-Record*, Oct. 9 and 23, 1924, pp. 575, 581 and 654). Although the trial court barred the

engineers named from exemptions on their compensation for consulting engineering work it allowed exemption to each member of the firm in an instance where he was a *"regular* official" of a municipal corporation—Metcalf as engineer of a water district in Maine and Eddy as engineer for a sanitary district near Chicago. True, this was in a suit for taxes on excess profits but the fundamentals must be the same for excess profits and ordinary income. In fact, the solicitor in the opinion under consideration cited the Metcalf and Eddy decisions in support of his own opinion, evidently overlooking the fact that the court had allowed exemptions to both Metcalf and each member of the firm in cases where they were "regular officials of a sub-division of a state."

It should be noted that the court decision was based partly on the language of the specific exemption clauses of the Internal Revenue Act and partly on a plea of the firm's attorneys that to collect a federal tax on income earned in the service of a state or city would be an impairment of state sovereignty and municipal efficiency, the second line of pleading apparently being designed to gain exemption if the court would not hold the attorney's clients free from tax under the specific exemption clauses. Nothing has come to our attention that shows why Metcalf as a "regular official" of a water district should be held exempt from the excess profits tax and any other and equally "regular" official or employee of that and of thousands of other municipally-owned water, light and other plants be not exempt from the income tax, but we admit the possibility of a higher than the Massachusetts trial court sustaining the internal revenue solicitor rather than the trial court. At the same time there is no doubt in our mind but what Congress intended to exempt from the federal income tax all municipal employees, whether legalistically classed as engaged on governmental or non-governmental functions.

In our editorial comment on the Metcalf & Eddy decision (Oct. 9, 1924, p. 574) we pointed out what from the engineer's viewpoint are anomalistic conceptions of governmental functions, such as classing sewerage as governmental because it affects the public health and excluding water supply, which far more vitally affects the public health. We also urged the need for a clearer definition of a "regular officer" of a municipality. The latter need would perhaps disappear, as regards income tax exemptions, if the solicitor's broad ruling is to hold good. If it were to hold, the questions as to "regular officials" would be thus wiped out and would be followed by others. Some of these are: If compensation to employees on municipally-owned waterworks and other utilities are subject to the income tax, why not revenues from all such utilities as well, and also why should bonds for municipal utilities be free from federal taxation? Likewise, how about the salaries of municipal employees who serve various departments, some performing governmental and some non-governmental functions, as held by the courts? In this category some city engineers, commissioners of public works, and other department heads, besides mayors under the mayor-and-council plan, city managers and some of the commissioners under the plain commission plan, where each commissioner heads an administrative department of the city

We realize that a correct interpretation of the law is necessary even though it does lead to conflict and confusion but that only makes it all the more desirable to urge upon lawyers and courts more attention to things as they are today, including progress in the science and art of government, and less attention to mere precedents established in past decades since when everything else but legal precedent has vitally changed.

Law Clearly Stated

CHICAGO has at last come to the end of her long defiance of federal authority in her diversion of the waters of the Great Lakes. For twenty-five years the city, through the Sanitary District, has gone ahead with a plan for disposing of the sewage which involved a use of lake water in amounts specifically refused by the United States, the sovereign controller of such water. Every possible legal device—including the delay of decision by a friendly judge—has been resorted to to put off the evil day when it would finally have to be admitted that whatever the necessities or demands of Chicago might be, the law was against them.

That day has now come. Clearly and succinctly, as is his habit, Mr. Justice Holmes reaffirms the sovereignty of the United States over navigable water. Chicago has never had any right to more than 4,167 sec.ft. down the Chicago River and she has had that only at the pleasure of the Secretary of War, who at any time could reclaim any or all of that flow if in his judgment navigation was being endangered. The United States is at all times sovereign and free to exercise its police power.

As is its custom the Supreme Court ruled on but one question of law—the right of the United States, through the Secretary of War, to limit the diversion. If Chicago is to continue in her present sanitary plan, she must therefore either procure a permit for more flow from the War Department or a law from Congress expressly authorizing a greater diversion. So far as can be predicted the War Department will not reverse its twenty-five year stand against greater flow, except possibly temporarily, though it may consider that navigation requirements, its only concern, will be satisfied for a time by control works to regulate flow and maintain levels in the lakes. There remains Congress and a new law.

But against both a new law or a War Department permit there stands the implication of the Supreme Court that any diversion over 4,167 sec.ft. is a matter of international interest and subject to adjudication under the treaty with Great Britain, a treaty signed in 1909 and confirmed in 1910, at which time whatever the actual diversion the legal diversion at Chicago, as now asserted by the Supreme Court, was limited to 4,167 sec.ft.

Only one phase of the Chicago controversy has been settled. The relative claims of the Mississippi valley as against the Great Lakes, the downstream power rights, both domestic and foreign, and the importance of the claimed sanitary necessities of Chicago, all remain to be determined. But the Supreme Court decision makes one thing perfectly clear—that the representatives of Chicago who for a quarter century persisted in defying the plain law of the land as asserted by federal authority have involved the city in a mess the way out of which is by no means clear today.

One of a Series of Articles on Details of Design and Layout of Different Types of Industrial Buildings

Contractor Maintains Service and Repair Plant

Contracting Business Develops New Type of Industrial Plant—Combines Storage with Repair Service and Fabrication of Special Articles

INCREASED size of construction operations and of contractor's organizations is creating a new type of industrial plant—the contractor's service plant. It combines the services of equipment storage and repair with manufacturing of a special nature. A recent notable example is the new plant in New York City of the Turner Construction Co., large contractors for reinforced-concrete and steel-frame buildings. This plant has been laid out with the experience of a score of years in building up the shop and yard services of a growing contracting business. It represents, then, mature and trained knowledge of requirements. The record of its growth is typical.

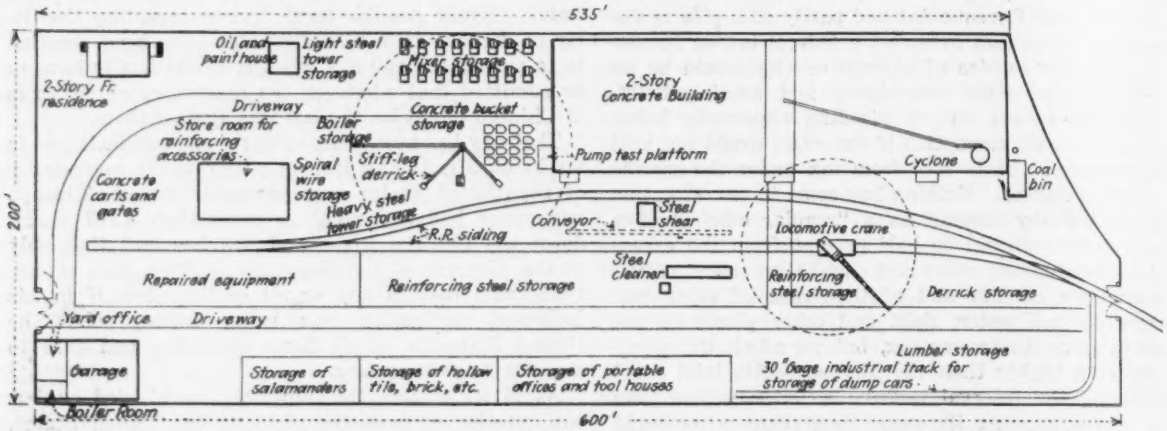


FIG. 1—GENERAL LAYOUT OF CONTRACTOR'S SERVICE PLANT

Developments of Service Plant Idea—At the very inception of the company's operations 22 years ago, a small yard was found necessary to handle steel reinforcements. At that time there were few types of deformed bars rolled, and no stock of this material was carried in the east. Twisted bars were largely used and it was often necessary to twist plain square bars to obtain the deliveries required. So a yard containing twisting machines was established quite early in the company's history, and from this nucleus the present shop activities were gradually built. Having a yard, naturally it became a place for storage and soon a bolt machine was added to recondition the large quantity of bolts used with the wooden forms. The old type of concrete mixer with the cast-iron rings gave considerable trouble, flat spots appeared on the rings requiring an occasional resurfacing. As the mixer drums are too large for an ordinary machine shop lathe it was necessary to return the mixer to the manufacturer for repairs, an expensive and time-consuming procedure. Consequently, a machine was designed to swing these drums and the rings were resurfaced at the yard. Arrangements were gradually made to make other repairs and eventually a fair-size machine shop was developed.

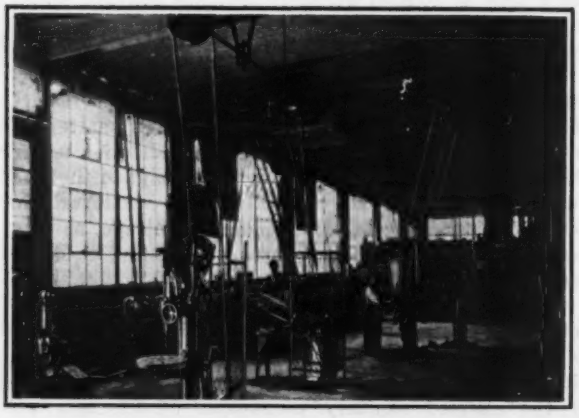


FIG. 2—VIEW ALONG MACHINE SHOP BAY

When electric operation came in the large number of electric motors employed in driving the machinery of a construction job required storage under cover and periodical cleaning. Then minor electrical repairs were made, until a considerable space was assigned to this work, and an electrical repair shop was developed.

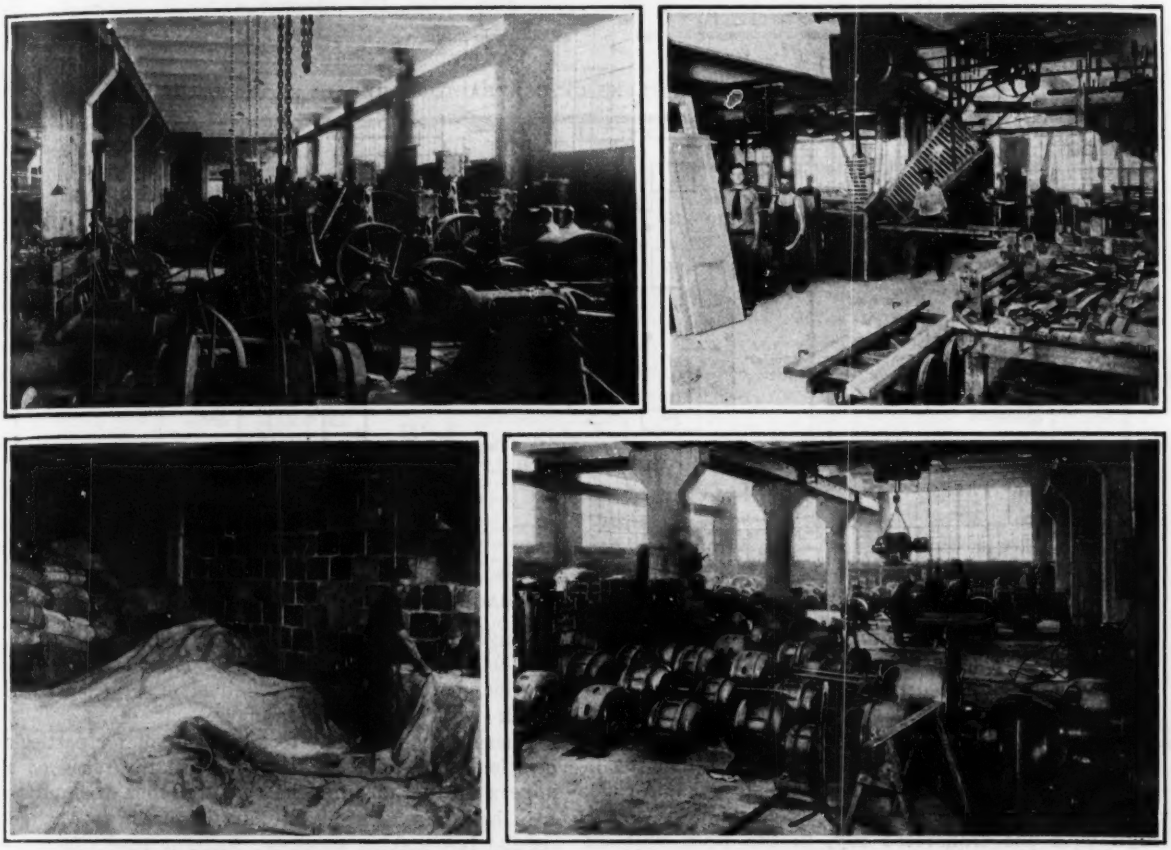
In the same way the activities of the shop were extended in other directions and as these activities were extended, more and more space was required. Additional sheds were put up until the saturation point was reached; then it was necessary to consolidate the sheds to save ground space, and a building, at first three stories high and eventually five was built. Space was allotted for the fireproof storage of office records—a troublesome item to any concern with a large volume of business.

The original yard was still crowded as the company's business increased; and after the war when there was a marked scarcity of steel products due to the coal and steel strikes, it was found desirable to have a large storage space for reinforcing bars which could be

accumulated at opportune times so that stock would be available when a quick building schedule should demand it. Additional yard area was accordingly secured at another location.

With the new yard and having railway connections it was recognized that considerable saving could be made in the shop operation by concentrating all of the activities at one location and the old yard and building were offered for sale. The sale having been effected it was possible to group the various classes of work done under one roof, and provisions were made at the repaired machines. The manufacturing function is of a very special nature.

Storage and Repairs—Storage of construction equipment is made a special problem by the miscellaneous character of the articles to be stored. Many articles as buckets, derricks, hoist towers, chuting and concrete mixers do not require housing. Others like electric motors, engines, rope and belting have to be well sheltered. Again, supplies like lumber and steel can stay out-of-doors while canvas, machine parts and tools should be housed. Repairs requiring machine tool



FIGS. 3-6—STORAGE, REPAIR AND SPECIAL MANUFACTURE OF EQUIPMENT
Fig. 3 (upper left)—Storage for gas and steam engines. Fig. 4 (upper right)—Corner in the wood mill.
Fig. 5 (lower left)—Corner in canvas repair room. Fig. 6 (lower right)—Electric motor storage and repairs.

new yard for a machine shop, machinery storage, an electrical motor shop and storage, general storage, office records storage, and a wood mill. The steel and lumber storage were maintained in the open yard. Enough experience had been gained to plan various units so that proper space was allotted to each, although conditions change somewhat from year to year. The importance of handling facilities had been learned so a locomotive crane handles material about the yard and unloads cars at the proper location, and light traveling cranes and trolleys supplemented by the ordinary flat cars and industrial track handle heavy machinery within the building.

Summarized briefly the new plant provides for three kinds of service: (1) Storage of equipment, (2) repair and testing of equipment and (3) manufacturing special articles. Included under repairing is the very important service of testing under load virtually all and bench operations are essentially indoor tasks but there are repairs of many sorts as framing derrick and tower timbers that are, weather permitting, preferably made in the open. These conditions all influence the planning of a contactor's service plant so that building costs may be reduced and yard space be wisely apportioned.

In the plant being considered the yard and building arrangement is shown by Fig. 1. The drawing gives the details. In general the noteworthy facts are that out-of-door storage is employed to about its permissible extent and building takes about its simplest form. Next in importance is the systematic provision of yard thoroughfares. There is no plant unit which is not accessible by truck or railway or from which stored equipment and supplies cannot be loaded or from which self-propelling equipment cannot get away by its own power.

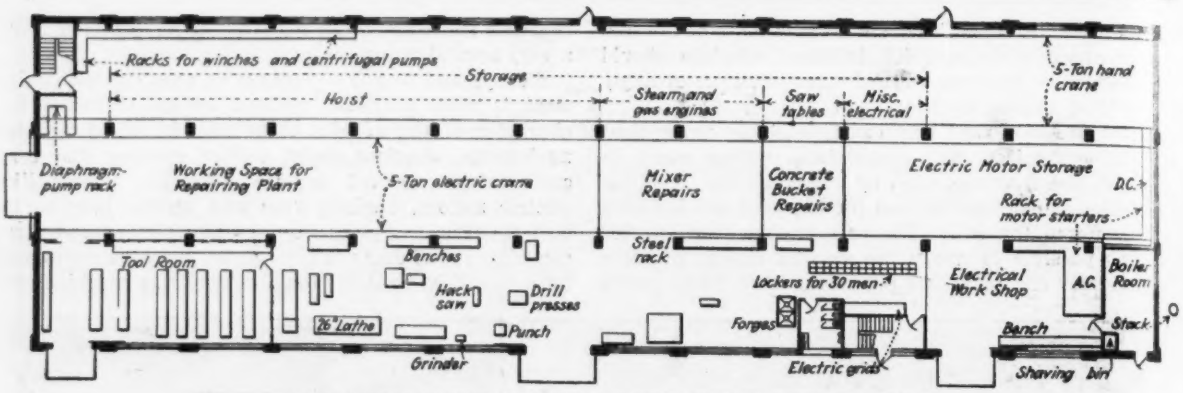
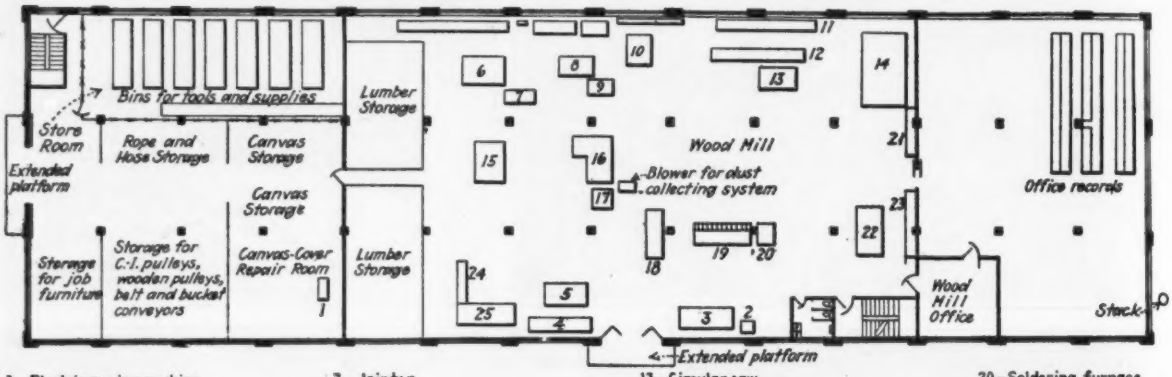


FIG. 7—FIRST FLOOR PLANS OF CONTRACTOR'S REPAIR SHOP



1—Electric sewing machine
2—Shear
3—Tinsmith bench
4—Hand brake
5—Tinsmith bench
6—Circular saw and boring machine
7—Jointer
8—Sticker
9—Band saw
10—Ironing machine
11—Swing saw and table
12—Rolling table
13—Circular saw
14—Nailing table
15—Chain mortiser-sticker
16—Circular saw-planer
17—Pulley and pocket machine
18—Tinsmith bench
19—Sheet iron rack and lockers
20—Soldering furnace
21—Hardware cabinet
22—Rack and bin
23—Bins
24—Tables
25—Power shears

FIG. 8—SECOND FLOOR PLAN, CONTRACTOR'S REPAIR SHOP

Virtually the only building that requires particular notice is the shop building, a substantial two-story structure of reinforced concrete. The two floor plans and the machine tool arrangement are shown by Figs. 7 and 8. The various views show the interior appearance and general structural character. The building is two stories and 72x250 ft. The first story has a clear height of 15 ft. 5 in., and the second story is 10 ft. high with one transverse bay, in the wood mill, 12 ft. high for handling large doors and frames. The distinctive feature to be observed is that the building provides both storage and repair shop service and that repair work has a wide range.

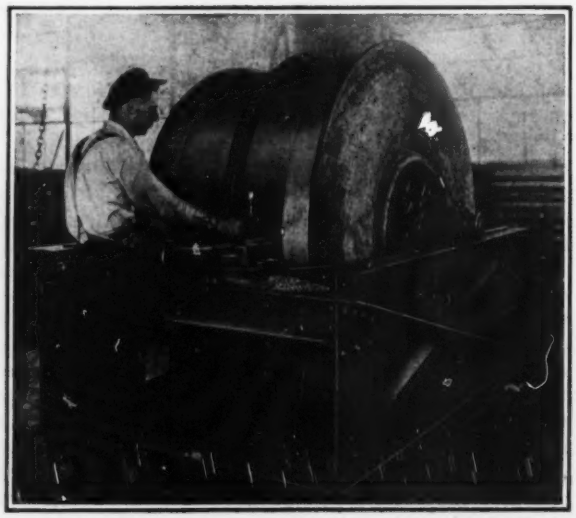


FIG. 9—TURNING DOWN TRACK ON MIXER DRUM

There are only a few tools which call for particular mention. The mixer lathe will turn the truck on all mixers up to 1 cu.yd. The bolt machines are equipped for threading reinforcing bars as well as for their regular bolt making services. Relining sheets for mixer drums and sheets for salamanders are made on the bending rolls. A unit of equipment that impresses one particularly is the machines for repairing canvas and waterproof covers and curtains. Two men are kept continuously busy at this task.

Testing Repaired Equipment—Experience has shown the wisdom of testing, preferably under load, certain equipment before sending it on to the job. One of the views shows a platform for testing pumps and another shows a Prony brake for testing steam and gas engines. As the electric power is 220-volt, 60-cycle, 3-phase current, transformers are provided for testing other alternating-current motors. Three generators are also provided for testing 110-, 220- and 500-volt direct-current motors. Larger machines like concrete mixers and hoists are tested by running without load. Load tests, however, are made of electric drills, air tools, electric floor grinders and similar small tools. It has been found that the assurance of a shop test that a repaired machine will operate when it gets out into the field is decidedly worth while.

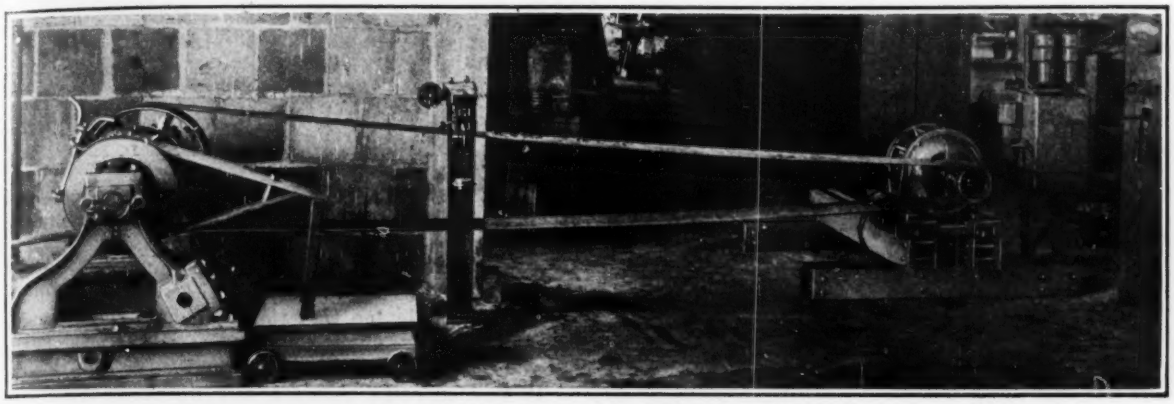


FIG. 10—PRONY BRAKE FOR TESTING ENGINES

Manufacturing Service—Such manufacturing as the plant does is producing special structural units or, fabricating small repair parts or equipment units like salamanders. A well-equipped wood mill forms part of the plant (Fig. 8). The machinery is modern and capable of turning out a wide variety of work both in wood and in metal-covered products. It has proved its usefulness in getting out special material, which is so troublesome to obtain from mills operating on standard products.

Handling Outfit—An outstanding feature of the shop and yard outfit is the handling equipment. In the yard there is a 15-ton 8-wheel locomotive crane with a 40-ft. boom which is used for loading and unloading all freight cars and trucks which come into and leave the yard. This crane is also used for handling all material to and from the wood mill on the second floor and can be used for handling supplies to the second floor stock room at the front of the building. An extended platform has been built at the wood mill and at the front of the building for placing and removing materials with the crane. A 7½-ton stiff-leg derrick with a 75-ft. boom, electrically operated, has been erected in front of the building. This derrick covers the area where heavy machinery, not requiring weather protection, is stored, such as concrete mixers and concrete buckets. The derrick is so placed that it can be used, if necessary, for loading and unloading freight cars and trucks and for placing and removing materials to and from the extended platform on the second floor of the building.

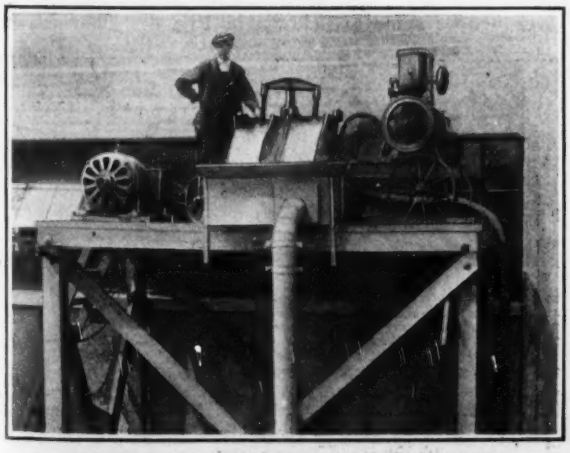


FIG. 11—TESTING REPAIRED PUMP UNDER LOAD

The following equipment for handling machinery has been installed in the building on the first floor: a 5-ton hand-operated trolley crane running the full length of the building and spanning the width of one bay over machinery storage; a 5-ton electric-operated trolley crane running the full length of the building, spanning the width of the center bay where machinery is repaired. This crane will pick up a 5-ton load at 12 ft. per minute and travels at the rate of 175 ft. per minute. The crane installed was purchased because it required very little headroom which meant a lower first-story height when the building was erected. There is sufficient headroom on the first floor so that an automobile truck can be driven into the building and loaded by this electric crane. In the electric and machine shop are erected several I-beam trolleys with chain hoists.

As described, the plant was designed and built by engineers of the Turner Construction Co., New York.

Algae in Public Water Supplies

By W. C. Purdy
Plankton Expert, U. S. Public Health Service

Abstract of paper read before the Fourth Ohio Conference on Water Purification, Cincinnati, Ohio.

Visible mats and masses of the larger algae are common in streams and sometimes in water reservoirs. The microscopic forms, however, are the ones most likely to give trouble through tastes or odors or clogging filters.

Copper sulphate is not always successful in combating algal growth. Chlorine has been used with good results where $CuSO_4$ has failed.

Sir Alexander Houston suggests the use of a coagulant, to be followed by lime, the latter to remove any CO_2 present, as this gas is a food material for algae. Another worker tried $CuSO_4$, also excess lime, with poor results. Then sulphuric acid was used in sufficient amount to neutralize all bicarbonates present, thereby removing this source (bicarbonates) of CO_2 for algal food. Good results followed this plan.

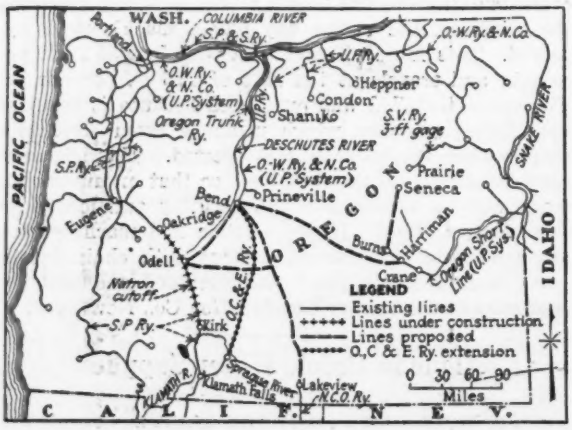
Algae may be an actual asset to the water on account of the excess oxygen they produce by photosynthesis, this oxygen being available for aerobic bacterial decomposition of organic matter. The extensive plant-filled shallow portions of the Potomac River were found to produce sufficient oxygen in this way to be a very material help in the oxidation of Washington sewage.

This production of excess oxygen is shared by the microscopic algae also, or the phytoplankton. The plankton of some streams consists chiefly of these minute plants, rather than of animals. Nearly a thousand weekly samples from the Illinois River at various points, and covering a period of 14 months, show a plant content of 65 to 95 per cent of the total plankton. Thus even a minute portion of water may possess a microscopic but efficient "home guard" which successfully competes with invasion of organic matter.

Railroad Developments in Oregon Reported On by I. C. C.

Two New Extensions and a Branch Line Are a Necessity, Interstate Commission Reports—Construction Plans

RAILWAY extensions to develop the central part of Oregon and provide improved through routes, as urged by the Public Service Commission of Oregon in an application to the Interstate Commerce Commission (see *Engineering News-Record* Oct. 16, 1924, p. 635) have been reported upon by an examiner of the latter commission, who concludes that both public necessity and national defense require the construction of two lines on general routes as follows: (1) A north and south link between Bend and Lakeview, with a connection to the Natron cutoff now being built by the Southern Pacific Ry.; (2) an east and west line from Harriman, on the Crane-Burns extension of the Union Pacific System, through Bend or Prineville to Odell, on the Natron cutoff. Surveys for both such lines were



NEW RAILROAD LINES PROPOSED IN CENTRAL OREGON

made during the period 1905-1912, when the Southern Pacific and Union Pacific system were co-ordinated under the Harriman regime. But under present control of existing lines the Harriman-Odell line would not be self-sustaining. A transfer of ownership of certain lines is suggested, therefore, for consideration under plans of railway consolidation. Furthermore, the report states that more direct rail routes across Oregon are needed, both to develop the resources of the state and to improve the national transportation system.

A definite recommendation is that the Union Pacific Ry. System be required to submit plans for the projected Bend-Odell-Lakeview extension. From Lakeview the narrow-gage line of the Nevada-California-Oregon Ry. extends to Wendell, Calif., on the Southern Pacific Ry.; this line would have to be converted to a standard-gage line. No mention appears to be made of the existing but independent standard-gage line of the Oregon, California & Eastern Ry., which is being extended northward to Bend.

According to the report, construction work would be light on the Bend-Odell line and on 80 per cent of the Harriman-Odell line, with heavier work on the remainder and on the Lakeview branch. No definite locations have been made, but the lengths and estimated

ESTIMATES FOR PROJECTED OREGON RAILWAYS

	Oregon Commission		Railroads	
	Miles	Cost per mile	Miles	Cost per mile
Bend-Odell	52	$48,643	64	$55,231
Harriman-Odell	171	51,625	189	61,852
Lakeview Branch	104	40,876	78	49,180

costs of the three lines as planned by the engineers of the complainant Oregon commission and the defendant railroads are given in the accompanying table. The examiner's report to the Interstate Commerce Commission states that the average of the two estimates is $52,000 per mile and that this was the actual cost for the first thirty miles of the Natron cutoff of the Southern Pacific Ry.

It may be noted that the new line from Crane to Burns and Seneca, mentioned in the former article as projected by a logging company and completed as far as Burns, is now a part of the Union Pacific Ry. System.

Water Supply and Sewage Disposal in the Ruhr Valley

Wells, Infiltration Galleries and Filter Basins Near River Supply Good Water Notwithstanding Sewage Discharge Into River

BY DR. KARL IMHOFF
Chief Engineer, Ruhrverband, Essen, Germany

THE drinking water supply of the three and a half million of inhabitants of the Ruhr district, Germany, is drawn from the River Ruhr, in the valleys of which are situated 90 different water-works which are partly owned by the municipalities and partly by private companies. The individual works are shown by dots (Fig. 2), the sizes of which indicate the relative sizes of the works. The daily average water consumption for all the works is 250 million gallons. Fig. 1, showing sewage-works, will be referred to later.

The water, which is taken from wells and infiltration galleries about 150 ft. from the river, is of excellent quality and fit for drinking as well as industrial purposes. At low water the bottom of the river becomes coated with sludge from the large volume of sewage and industrial wastes which the river carries. Frequently, the river bottom is coated with sludge to such an extent that no water can penetrate the gravel and pass to the filter wells and galleries. The water-works have, therefore, built filter basins, which are fed by river water; some are shown in Fig. 3. They extend

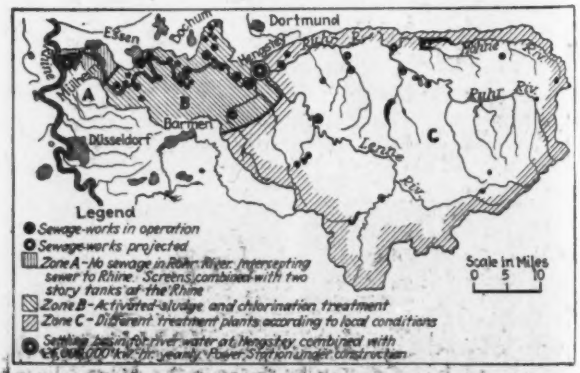


FIG. 1—SEWAGE-WORKS IN RUHR VALLEY BUILT AND OPERATED BY RUHR SANITARY DISTRICT

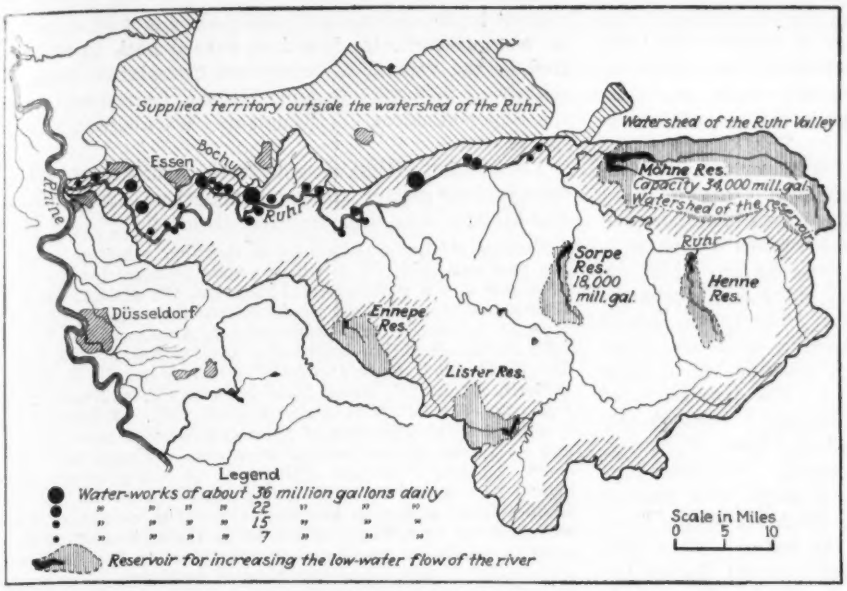


FIG. 2—WATER-WORKS IN RUHR VALLEY AND RESERVOIR OWNED BY RUHR RESERVOIR ASSOCIATION

through the clay of the river valley to gravel. The bottom of these filter basins is covered with a layer of sand which has to be periodically cleaned. To avoid disturbing the ground-water conditions, two filter basins are always installed side by side, so that one may be used while the other one is being cleaned. In most cases the cleansing is necessary once a year only.

The natural cleaning of the river water is done so thoroughly that the water becomes fit for immediate consumption. Only at times of very low water or very high water is chlorine used to keep down the number of bacteria in the water.

The quantity of water drawn from the Ruhr by the water-works is already much larger than the natural low-water flow of the river. This condition would be intolerable if an amalgamation of the water-works had not taken place at Essen twenty years ago (the "Ruhr-Talsperren Verein" — Ruhr-reservoir or water-works corporation) for the purpose of replacing the water drawn from the River Ruhr. This is done by the erection of impounding reservoirs. The largest of these reservoirs, which is situated in the valley of the Möhne, has a capacity of 130 m.cu.m. (34,000 m.g.). This reservoir is at the same time connected with a hydro-electric power station (Fig. 4) which yearly produces 10,000,000 kw.-hr. The Corporation of the Ruhr Water-Works (the Ruhr-Talsperren Verein) raises its construction funds by loans and the money to meet the yearly interest and working expenses is supplied by the water-works. Power was given to the corporation by a bill, passed into law on June 5, 1913, to collect all contributions in the same manner as taxes. The corporation is the absolute owner of the impounding reservoirs and the power stations.

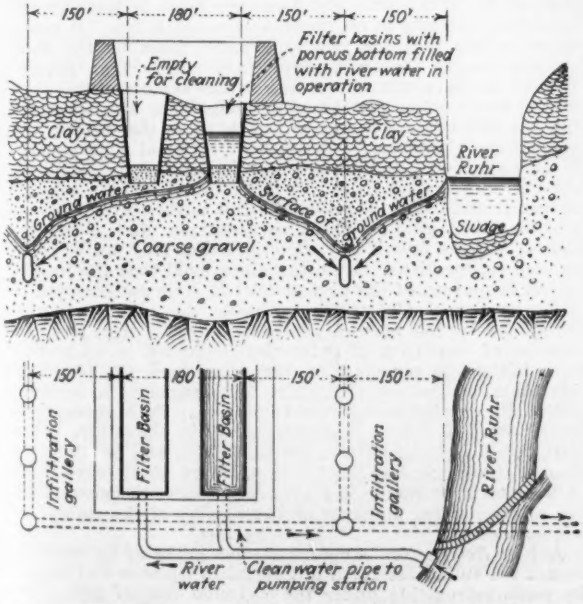


FIG. 3—FILTER BASINS TO AUGMENT WATER SUPPLY FROM INFILTRATION WELLS AND GALLERIES

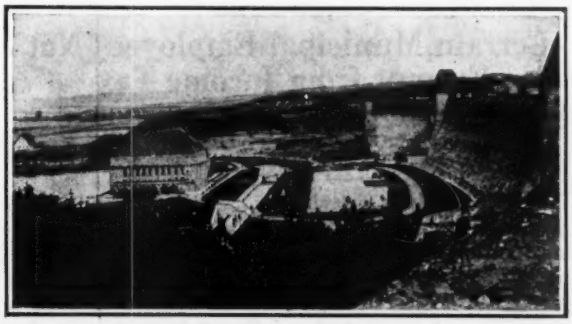


FIG. 4—HYDRO-ELECTRIC STATION AT HENGSTEY

This station uses the head made available by a compensation reservoir built by the Ruhr-Talsperren Verein or reservoir corporation to make up for water diverted from the River Ruhr for municipal supply.

The Ruhr-Talsperren Verein is about to build a new reservoir, the "Sorpe Talsperre," which is to have a capacity of 70 m.cu.m. (18,000 m.g.), so that all the water needed by the water-works will be secured for a long time to come.

The water-works have, however, another danger to overcome, that is the ever-increasing pollution of the Ruhr by the drainage of the towns and industrial works. To meet this second danger, the aforesaid law of June 5, 1913, has called into existence the "Ruhr Verband" (Sanitary District of the Ruhr Valley). It is the duty of this council to keep the River Ruhr and its contributaries in a sweet condition. The black dots on Fig. 2 show the sewage-works which the Ruhr Verband has already built and put in full working order. The circles indicate sewage-works which will be built in the near future.

The Ruhr Verband has divided the whole district into three parts, A, B and C. Part A includes the three large towns of Mülheim, Oberhausen and Duisburg, which have much sewage. Three large water-works are located in Part A. The ordinary method of sewage treatment could not be used here. The Ruhr Verband has therefore built an intercepting sewer which directs the sewage of these three towns away from the Ruhr to the Rhine, where a large sewage-works consisting of screens and two-story sedimentation tanks will be built.

District B is the proper water-works line which extends from Mulheim upwards to Hengstey, where the River Lenne flows into the Ruhr. The Lenne carries mostly industrial wastes containing acid and iron, whereas the Ruhr brings much alkaline waste from paper mills and other factories. The two kinds of sewage act together like precipitants; consequently large quantities of sludge are collected below Hengstey, which interfere with the water-works. The Ruhr Verband is therefore going to erect a large river settling basin at Hengstey, by means of which the sludge from the Ruhr, at the usual flow of the water, will be held up. At high water, which usually occurs during the winter months, the sludge will be discharged without injury to the water-works. A valuable additional profit is attained from the damming up of the river water at Hengstey. This water, having a head of 8 m., is used in a power station (Fig. 4) producing 26,000,000 kw.-hr. yearly and yielding an income far more than enough to pay the interest and amortization charges on the capital outlay.

Certain Municipal Employees Not Exempt from Income Tax

Federal Ruling that Compensation for Services Rendered to Municipally-Owned Utilities Is Liable to Tax

THROUGH the activity of Senator Shortridge of California there have been brought to general public attention rulings of Solicitors of Internal Revenue that municipal employees on public utilities or other enterprises classed legally as non-governmental in character are not exempt from the federal income tax under the Internal Revenue Act of 1921. The opinions apply equally to state employees of the same class. Senator Shortridge, without any pronouncement on the merits of the ruling, has stated that he proposes to look into the matter.

The ruling, which was dated Sept. 1, 1924, and signed by Nelson T. Hartson, Solicitor of Internal Revenue, is supplementary to Solicitor's Opinion 152 (C. B. II-2 93, July-Dec., 1923) in which, according to the language of the ruling of Sept. 1, "it was held that the compensation of employees of a street railway owned and operated by a municipality was not exempt from federal income tax under the Revenue Act of 1921, upon the theory that the operation of a street railway is not a governmental function of a city." The ruling of Sept. 1 extends the application of this opinion to cover (according to the syllabus) "services rendered in connection with a municipally-owned water system," the "income of the employees of the port district X" and "the salaries of the managers and employees of cafeterias conducted in connection with public schools."

Information obtained from the office of the Commissioner of Internal Revenue indicates that the ruling applies to all incomes of municipal employees engaged on non-governmental functions earned back to and including the year 1918; also that Cumulative Bulletin containing Solicitor's Opinion 152 may be obtained from the Superintendent of Documents, Washington, D. C., for 30 cents.

The opinion in full, except for the syllabus and other introductory matter already summarized, follows (the side-heads having been inserted editorially):

Federal Attitude Governs—In deciding whether or not any particular activity in which a state or municipality may be engaged is a governmental function, the attitude of the federal, rather than the state authorities should govern. (See *St. Louis Cotton Compress Co. v. Arkansas*, 260 U. S., 346; *Boston & Maine Railroad v. United States*, 265 Fed., 578, T. D. 3004; *Lane Lumber Co. v. Hynson*, T. D. 3593; Bulletin III-22, 22; *Boise Title & Trust Co. v. Evans*, 295 Fed., 223 (T. D. 3551; Bulletin III-8, 10). Where there is a substantial difference of opinion among the state courts and no ruling of any federal court, the decisions of those courts holding a certain activity to be non-governmental should be followed in every state, regardless of the rulings of individual states to the contrary. The existence of a well-founded or rational doubt as to the character of the activity should be considered as equivalent to the denial of a claim for exemption on behalf of an employee. In general, the rule that exemptions from taxation are to be strictly construed should be applied and no intendment should be taken in favor of the taxpayer in doubtful cases. (See *Wright v. Georgia, etc., R. R. Co.*, 216 U. S. 420.)

Water-Works Non-Governmental—In the brief filed on behalf of the employees of the municipally-owned water-works system, decisions of the courts of the state holding that the operation of a water-works system of a city is an exercise of a governmental function are cited. The United States District Court for the District of Massachusetts on May 21, 1924, however, decided that compensation received for services rendered in connection with a municipally-owned water system was not exempt from income tax. (*Metcalf & Eddy*, unreported to date.) This appears to be in harmony with the rulings of the federal courts holding municipal water-works to be non-governmental in cases other than those involving income taxes (*Winona v. Botzet*, 169 Fed., 321), as well as with the weight of authority among the states, and should be followed in all cases, irrespective of the attitude of the courts or statutes of the individual states.

Status of Port Districts—A ruling is also requested as to the status of an employee of the port commission of the port of X. While port districts have been declared by the courts of the state to be "municipal corporations," it seems quite certain that the powers granted them by the state statutes are in the main proprietary rather than governmental in character. According to the state statutes none of the usual police powers of municipalities are delegated, but the districts appear to be restricted to the owning and operating of "wharves," "elevators," "terminal icing plants," "tramways," etc., and modern appliances for the handling, storing, and transporting of freight and handling of passenger traffic. They are made subject to the state laws regulating other public service corporations, and altogether appear to have few, if any, functions that may not be given private corporations. It is, therefore, held that the income of the employees of the port district of X is not exempt.

Public School Cafeterias—Among the other activities mentioned in the queries presented to this office are the salaries of employees of cafeterias conducted in connection with the public schools. In purveying food, the board of education, or the school district, is engaged in a business ordinarily carried on by private persons. Such enterprises have been held not to be governmental in character. (See *Salt Lake City v. Hollister*, 118 U. S., 256, and *South Carolina v. United States*, 199 U. S., 437, and other cases cited in Solicitor's Opinion 152.) It seems clear, therefore, that the salaries of the manager and employees of the cafeterias are not exempt.

Ruling Retroactive—Inquiry is also made as to whether or not the ruling set forth in Solicitor's Opinion 152 should be made retroactive under the Revenue Act of 1921. In the opinion of this office that ruling necessarily controls all cases arising under the act referred to.

Heavy Foundations on Sand Rock, Nebraska Capitol

Building of Large Area with Heavy Tower at Center Required Load Tests to Determine Design of Foundation—Pier and Pile Foundations Carried to Rock by Open Excavation in the Dry

By Ralph H. Chambers
Vice-President, Jarrett-Chambers Co., Inc., New York

THE NEW Nebraska State Capitol, at Lincoln, now in course of construction, will be a marked departure from the usual type of such structures. The plans for the building were made by the late Bertram G. Goodhue. The building proper, 437 ft. square, will be a comparatively low structure, covering a large area (nearly 4½ acres) and rising by successive terraces from its periphery towards a central tower, which is surmounted by a figure, "The Sower," and reaches a height of 400 ft. above the ground surface (Fig. 1). Interesting foundation work was involved in its construction.

In plan (Fig. 2) the quarters for the administrative offices of the state government, built in the form of a hollow square, will enclose a cross-shaped structure which will provide the legislative halls, grand foyer and court rooms. Between these two main sections of the building are four open courts, each about 80x100 ft., which furnish air and light to all the interior rooms of the building. The whole building will be surrounded by a one-story terrace, with suitable approaches on each of the four facades.

Loads—Some steel-frame construction will be used, but in general the capitol will be of heavy masonry construction. Therefore, although the building outside the tower will be comparatively low, its weight will be great and the loads upon the foundations will be heavy. The computed weight of the building and contents is 180,000 tons; of this the weight of the tower is about 35,000 tons. The foundation loading at any one corner of the tower base may be increased on account of the effect of wind by an additional 3,500 tons.

Subsurface Conditions—Like the greater portion of Nebraska, the city of Lincoln and the site of the capitol is underlain by a stratum of loess, a mixture of silt and clay of glacial origin, very dry, hard and firm. Most of the buildings in Lincoln, including the larger modern buildings and the new buildings of the University of Nebraska, are founded upon this loess. On the site of the capitol this stratum has a depth below the surface of 17 to 32 ft. Below this there is a stratum of glacial drift, consisting of sand, gravel and clay, of a depth varying from 4½ to 23 ft., and immediately below this lies the rock. The upper surface of the rock to a depth of a few feet is somewhat impaired in value by the admixture of clay.

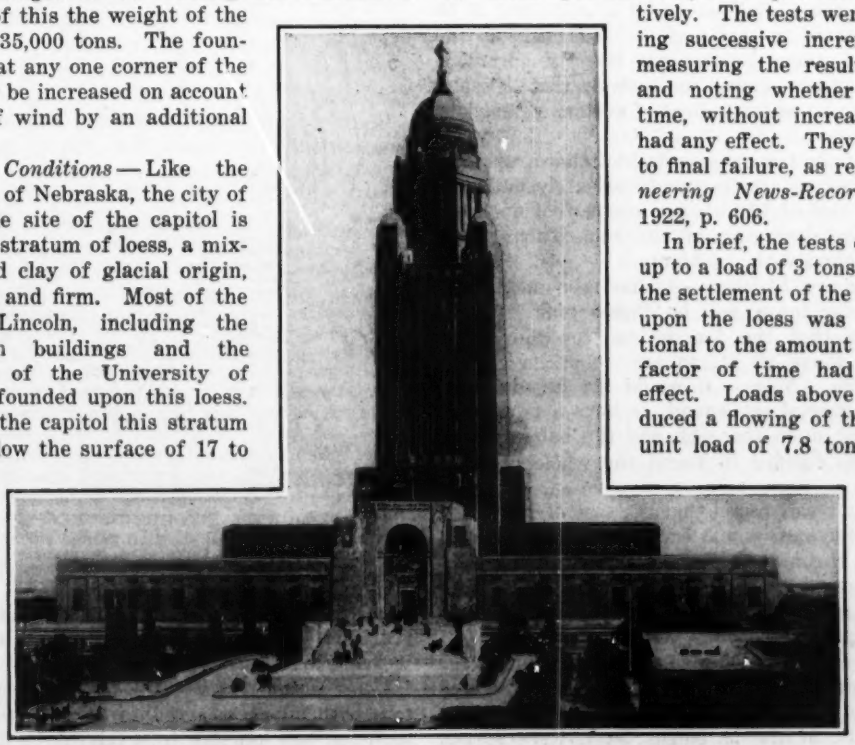


FIG. 1—NEBRASKA STATE CAPITOL, FROM ARCHITECTS' DRAWING

The rock, Dakota sandstone, is an almost pure silica sand, light buff in color and very weakly cemented. It is very porous and when removed from its original bed it crumbles easily in the hands and has little cohesion. When exposed in original beds to the air, while it does not harden, it is not deteriorated and, although of very porous structure, it does not seem to be affected by the absorption of water. It can be easily cut out by pick and shovel or by mattock and it is so porous that in appearance it does not much differ from a bed of clean bright sand. On the other hand it does have a distinct structure as is evidenced by a ring when it is struck. This stratum is of very great depth, probably over two hundred feet and certainly more than half of this depth at the site of the capitol.

Bearing Tests—As there was a total lack of definite data relating to the sustaining capacity of either the stratum of loess or of the underlying sand rock, the engineers appointed to make the plans for the foundations of this building prepared a program of large-sized bearing tests to be made both upon the loess and upon the sand rock. This program provided for the loading of an area of 16 sq.ft. upon the loess and of two areas upon the rock, of 1 sq.ft. and 4 sq.ft. respectively. The tests were made by adding successive increments of load, measuring the resulting settlement and noting whether the factor of time, without increase of the load, had any effect. They were continued to final failure, as reported in *Engineering News-Record* of Oct. 12, 1922, p. 606.

In brief, the tests determined that up to a load of 3 tons per square foot the settlement of the bearing surface upon the loess was exactly proportional to the amount of load and the factor of time had apparently no effect. Loads above this limit produced a flowing of the soil, and at a unit load of 7.8 tons the soil completely failed. The two tests upon the sand rock were somewhat discordant. The test upon the area of 1 sq.ft. showed that the rock was truly elastic up to a load

of 63 tons, but at that point the rock failed without warning and the bearing plate sank more than 6 in. into the rock. The second test, upon an area of 4 sq.ft.,

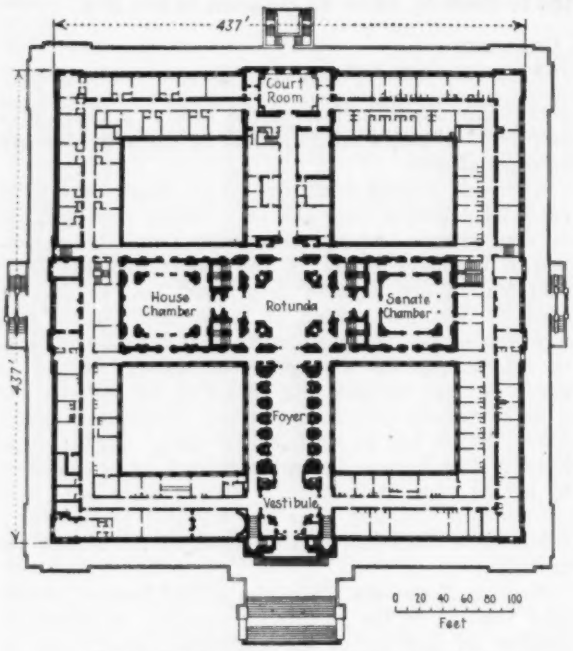


FIG. 2—GROUND PLAN OF NEW CAPITOL
Legislative halls in central cross-shaped structure, administrative offices in outer square.

did not fail until the unit load had reached 92 tons but at that point it did fail suddenly, the bearing plate sinking more than 13 in. into the rock. However, the second test showed a distinct set at a unit load of 60 tons and thereafter the ratio of the settlement to the amount of load differed somewhat from its previous value. The two tests showed conclusively that the sand rock will sustain an ultimate load of 60 tons per square foot.

As a result of the tests it was decided that a working load of 2 tons per square foot could be safely put upon the loess and a load of 12 tons per square foot upon the sand rock. The designing of the foundations could then be undertaken with confidence.

Choice of Bearing Stratum—As has been mentioned, the weight of the tower will be 35,000 tons. It was evident at once that the foundations for the tower, which will be about 80 ft. square, must be carried down to the rock. Also as it would not be advisable, on account of unequal settlement, to have a portion of the building rest upon the rock and the balance upon the loess, it was decided to found the whole building on the rock.

Furthermore, it was found that the cost of spreading the loads upon the loess would exceed the cost of carrying piers down through the loess to the rock, particularly as the general excavation required for the basement reduced materially the required depth of the foundation piers.

Foundations—The general idea used to determine the form of the foundations was to carry all concentrated loads directly to the rock by independent concrete piers. Where the loads, at the basement level, were spread over large areas, reinforced-concrete caps were provided to carry the loads to suitable piers and the concrete basement walls were reinforced to accomplish a like purpose. Except in the tower footings no reinforcement was used in the piers and they were dimensioned to carry the loads at 28.8 tons per square foot of section. At the bottom they were belled out to spread the load upon the rock at 12 tons to the square foot. Concrete piles were used for the footings of the approaches to the terrace. The foundations for the tower consisted of four concrete piers at each of the corners of the tower.

Altogether, exclusive of the tower foundations, 447 piers were required, of which 342 were 4 ft. in diameter, belled out in proportion to the load to be carried to a maximum of 6 ft. 3 in. The remaining 105 piers varied in diameter from 4 ft. 3 in. to 6 ft. 9 in. and were belled out at the bottom to diameters from 6 ft. 3 in. to 10 ft. The tower foundations varied from 8x8 ft. belled out to 12x12 ft., to piers which were 29 ft. 6 in. square at the bottom.

Construction—The conditions at this site were such that the construction of the foundations was of the simplest nature. After the general excavation for the basement was completed the pier excavations were made in the hard dry loess by hand labor and without the use of sheeting or bracing. No pumping was required. The excavations for the piers were carried down roughly to the rock. Wooden templets were then placed at the tops and bottoms, in exact positions, and the sides of the holes were dressed off to a straight-

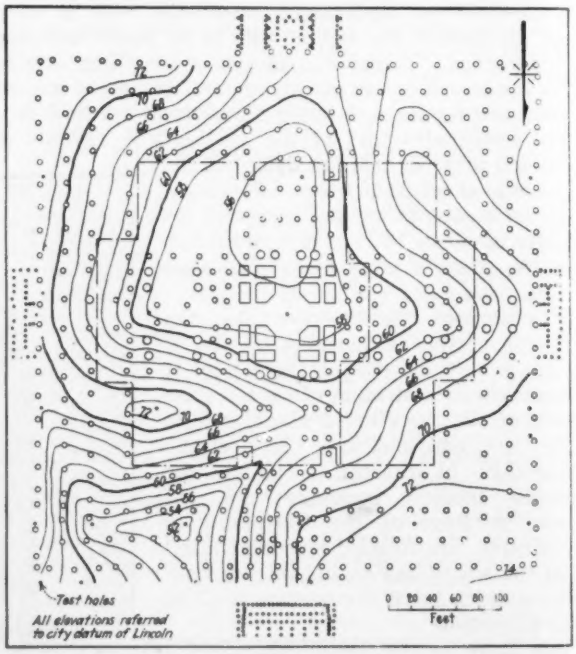


FIG. 3—ROCK CONTOURS DEVELOPED BY BORINGS
Three contour plans, showing ground surface, top of gravel stratum, and rock surface, were prepared in advance of bidding, to give full information to prospective contractors.

edge. After the completion of the shaft excavations the bells at the bottom were cut out in the sand rock by hand mattocks.

Construction Data—To provide prospective contractors with all necessary data 31 borings were made, at more or less regular intervals, down to and into the rock. From these, three contour maps were made to

show the surface of the ground at the site, the surface of the gravel stratum and the surface of the rock. Each of the foundation piers was shown to scale upon these maps (Fig. 3).

The concrete piles were constructed by boring with an earth auger down to and into the rock. The holes so made were clean and dry and were filled up to the required level with concrete.

The final result was a foundation of the simplest and most positive character and one which could be built at a minimum of cost.

The portion of the building which will be devoted to the administrative offices has been completed around the old capitol building and the demolition of the old building and the construction of the legislative halls and the tower will be immediately begun.

The construction of the capitol is being carried out under the direction of Bertram Grosvenor Goodhue's Associates, of New York. The details of the bearing tests were carried out by the Nebraska Department of Public Works under the direction of Prof. Clark E. Mickey of the University of Nebraska. The foundations for the first section of the building were constructed by the W. J. Assenmacher Co., Inc., of Lincoln. The investigations and plans were made and the work was supervised by the Jarrett-Chambers Co., Inc., of New York.

Steamer Carrying Bulk Cement Has Self-Unloading Plant

A 350-TON lake steamer for carrying cement in bulk and with electrically operated screw conveyors for discharging the cargo was described in a paper by Henry Penton and Prof. Herbert C. Sadler at the recent annual meeting of the Society of Naval Architects and Marine Engineers. Self-unloading steamers carrying coal and broken stone have pan or belt conveyors, but screw conveyors were adopted as preferable for such fine materials as cement and are considered suitable also for grain, flax and other materials having small particles. An abstract of the description of the steamer is given below:

Cement, especially when first loaded and therefore in a somewhat aerated state, will flow almost as a liquid. In designing, therefore, it is advisable to treat it as practically a liquid cargo so far as stability is concerned. In order to expedite unloading as well as to better utilize cubic space, four sets of conveyors are arranged under the hoppers, discharging into two bucket elevating conveyors. The vessel has the ordinary double bottom construction, with additional side tanks under the outboard hopper slopes. The upper portion is framed on the arch system, as usual with all lake vessels for some years past. With the exception of some moderate sized hatch openings at the bulkheads for access to each hold, the upper deck is completely plated but has a number of openings about 18 in. in diameter through which the cement is run into the hoppers. These openings are fitted with watertight screw-down covers.

Three shifting boards, composed of steel plates stiffened with angles, are fitted along the ridges of the hoppers, in order to confine the movement of the cement when it reaches a depth of about 18 in. above the hopper tops. The hopper slopes are from 40 to 45 deg., and the cargo is discharged to the conveyors through openings in the vertical plate at the bottom, these openings being spaced about 3 ft. apart. The machinery is placed as far aft as possible in order to obtain an unbroken hold and clear deck for the length of the hoppers. The cargo is loaded from the shore storage bins through inclined spouts spaced to suit the small circular hatches in the deck, the latter being placed approximately over the center of each hopper. Forward of the hoppers is a cargo hold for general service purposes. The unloading machinery consists of four screw conveyors at the forward end which deliver to bucket elevators which in turn deliver to a cross-conveyor above deck and can be adjusted to discharge over either side of the ship to bins ashore.

When the cement is first deposited it is in a somewhat aerated state and flows freely, but towards the end of the voyage it is apt to become compacted. In order to avoid trouble with the conveyors during unloading, the owners of the vessel have developed and control a device by means of which the cement is again aerated by compressed air which is forced through the cement. This, in conjunction with special feeding devices which regulate the flow, enables the conveyors to be run at their maximum capacity without clogging. The whole conveyor system is electrically operated, power being supplied by a 500-kw. turbo-generator set. Control stations are located at suitable positions so that the system can be operated from more than one point. A small compartment at the after end of the hoppers contains the ventilating fans and dust collectors. The cement may sometimes be put into the ship at a fairly high temperature, so that good ventilation, as well as freedom from dust, in the working spaces under the hoppers, is essential. Six "wrecking wells" extending from the deck down through the hoppers are also arranged to serve as ventilators to the space below.

This vessel has loaded cargo at the rate of 4,500 barrels or 850 tons per hour and has discharged it at the rate of 2,400 barrels or 460 tons per hour. The steamer, built by the Toledo Shipbuilding Co., is 350 ft. long, has a 55-ft. beam and is 28 ft. in depth, the large width of beam being due to the fact that both length and depth are limited at some of the ports. The dead-weight on 18 ft. draft is 5,700 net tons. A triple expansion engine gives a speed of 11 m.p.h.

National Forest 1923-4 Sales Break Records

All yearly records of cut of timber from the 147 national forests were broken during the calendar year 1923 when the total cut exceeded a billion board feet, for the first time in history, states W. B. Greeley, chief of the Forest Service, in his annual report. This cut was an increase of 20 per cent in quantity over 1922 and had a value 23 per cent greater. Speaking of the fiscal year ending June 30, 1924, the report says that both cut and receipts surpassed the calendar year of 1923. Sales for the calendar year 1923 also exceeded all records, with a total of over three billion board feet, which had a contract value over $9,000,000; this was 68 per cent greater in quantity and 7 per cent in value than 1922. The report says: "This increase in the national forest sales, particularly in the three Pacific Coast states where the volume of current business is heaviest, is striking evidence of the continued and increasing westward movement of the lumber industry from the cut-over regions of the East. . . . In one instance a lumber company with its entire organization was bodily moved by special trains from the southern yellow-pine region to Arizona." Of the 24 states and territories containing national forests, the first ten, in order as to quantity of timber cut, were: California, Oregon, Washington, Idaho, Montana, Alaska, Wyoming, Arizona, Colorado and South Dakota. All sales of timber from the national forests take into account the sustained yield principle, affording a perpetual supply on the sale area. One of the outstanding sales of the year was made on the Cascade Range in Oregon. The unit sold embraces 15,700 acres with an average stand of 44,000 bd.ft. per acre, 90 per cent of which is Douglas fir. Under the management plans for this sale the timber will be cut at the rate of about 50,000,000 bd.ft. per year.

Supreme Court Restricts Chicago Drainage Diversion

Text of Unanimous Decision Written by Justice Holmes Handed Down Jan. 5—Affirms Lower Court Injunction Restricting Chicago River Flow to 4,167 Sec.-Ft.

THIS is a bill in equity brought by the United States to enjoin the Sanitary District of Chicago, a corporation of Illinois, from diverting water from Lake Michigan in excess of 250,000 cu.ft. per min.; the withdrawal of that amount having been authorized by the Secretary of War. It is alleged that the withdrawal of more, viz., from 400,000 to 600,000 cu.ft. per min., has lowered and will lower the level of the water of Lake Michigan, Lake Huron, Lake St. Clair, Lake Erie, Lake Ontario, Sault Ste. Marie, St. Mary's River, St. Clair River, Detroit River, Niagara River, St. Lawrence River, and all the harbors, etc., connected therewith, all of which are alleged to be navigable waters of the United States, and will thus create an obstruction to the navigable capacity of said waters; and that it will alter and modify the condition and capacity of the above named and their ports, etc., connected with them. The prohibition of such alterations and obstructions in the Act of March 3, 1899 (c. 425, Sec. 10; 30 Stat. 1121, 1151), is set out at length and relied upon but the frame of the bill does not exclude a reliance upon more general principles if they were needed in order to maintain it.

The withdrawal practiced and threatened is through an artificial channel that takes the place of the Chicago River, formerly a little stream flowing into Lake Michigan, and of a part of its branches. The channel instead of adding water to the lake has been given an opposite incline, takes its water from the Lake, flows into the DesPlaines River, which empties into the Illinois River, which in its turn empties into the Mississippi. The channel is at least 25 ft. deep and at least 162 ft. wide; and while its interest to the defendant is primarily as a means to dispose of the sewage of Chicago (*Missouri* v. *Illinois*, 200 U. S. 496), it has been an object of attention to the United States as opening water communication between the Great Lakes and the Mississippi and the Gulf.

Allegations—The answer shows the defendant is proceeding under a state act of May 29, 1889, which provided that a channel should be made of size sufficient to take care of the sewage and drainage of Chicago as the increase of population might require, with a capacity to maintain an ultimate flow of not less than 600,000 cu.ft. of water per minute, and a continuous flow of not less than 20,000 cu.ft. for each 100,000 of the population within the sanitary district. It denies that the defendant has abstracted from 400,000 to 600,000 cu.ft. per min., but as it alleges the great evils that would ensue if the flow were limited to the amount fixed by the Secretary of War or to any amount materially less than that required by the state act of May 29, 1889, and as it admits present conditions to be good, the denial cannot be taken very seriously. The act sufficiently indicates what the state threatens and intends to do unless stopped. The answer also denies that the abstraction of water substantially in excess of 250,000 cu.ft. per min. will lower the levels of the lakes and rivers concerned or create an obstruction to the navigable capacity of those waters. It goes into the details of the construction of the channel; the expenses incurred; and the importance of it to the health of the inhabitants of Chicago, both for the removal of their sewage and avoiding the infection of their source of drinking water in Lake Michigan which had been a serious evil before. It shows the value of the channel for the great scheme of navigation that we have mentioned; recites acts of Congress and of officers of the United States alleged to authorize what has been done, and to estop the United States from its present course, and finally takes the bull by the horns and denies the right of the United States to determine the amount of water that should flow through the channel or the manner of the flow.

This brief summary of the pleadings is enough to show the gravity and importance of the case. It concerns the expenditure of great sums and the welfare of millions of men. But cost and importance, while they add to the solemnity of our duty, do not increase the difficulty of decision except as they induce argument upon matter that with less mighty interests no one would venture to dispute. The law is clear, and when it is known the material facts are few.

United States Sovereign—This is not a controversy between equals. The United States is asserting its sovereign power to regulate commerce and to control the navigable waters within its jurisdiction. It has a standing in this suit not only to remove obstruction to interstate and foreign commerce, the main ground, which we will deal with last, but also to carry out treaty obligations to a foreign power bordering upon some of the lakes concerned, and, it may be, also on the footing of an ultimate sovereign interest in the lakes. The Attorney General by virtue of his office may bring this proceeding and no statute is necessary to authorize the suit. (*United States* v. *San Jacinto Tin Co.*, 125 U. S. 273.) With regard to the second ground, the Treaty of January 11, 1909, with Great Britain, expressly provides against uses "affecting the natural level or flow of boundary waters" without the authority of the United States or the Dominion of Canada within their respective jurisdictons and the approval of the International Joint Commission agreed upon therein. As to its ultimate interest in the lakes the reasons seem to be stronger than those that have established a similar standing for a state, as the interests of the nation are more important than those of any state. (*Re Debs*, 158 U. S. 564, 584, 585, 599; *Georgia* v. *Tennessee Copper Co.*, 206, U. S. 230; *Hudson County Water Co.* v. *McCarter*, 209 U. S. 349, 355; *Marshall Dental Manufacturing Co.* v. *Iowa*, 226 U. S. 460, 462.)

The main ground is the authority of the United States to remove obstructions to interstate and foreign commerce. There is no question that this power is superior to that of the states to provide for the welfare or necessities of their inhabitants. In matters where the states may act the action of Congress overrides what they have done. (*Monongahela Bridge Co.* v. *United States*, 216 U. S. 177; *Second Employers' Liability cases*, 223 U. S. 1, 53.) But in matters where the national importance is imminent and direct even where Congress has been silent the states may not act at all. (*Kansas City Southern Ry. Co.* v. *Kaw Valley Drainage District*, 233 U. S. 75, 79.) Evidence is sufficient, if evidence is necessary, to show that a withdrawal of water on the scale directed by the statute of Illinois threatens and will affect the level of the lakes, and that is a matter which cannot be done without the consent of the United States, even were there no international covenant in the case.

Estoppage—But the defendant says the United States has given assent to all that has been done, and that it is estopped to take the position it now takes. A state cannot estop itself by grant or contract from the exercise of the police power. (*Texas & New Orleans R. R. Co.* v. *Miller*, 221 U. S. 408, 414; *Atlantic Coast Line R.R. Co.* v. *Goldsboro*, 232 U. S. 548, 558; *Denver & Rio Grande R.R. Co.* v. *Denver*, 250 U. S. 241, 244.) It would seem a strong thing to say that the United States is subject to narrower restrictions in matters of national and international concern. At least it is true that no such result would be reached if a strict construction of the government's act would avoid it. This statement was made and illustrated in a case where it was held that an order of the Secretary of War under the Act of March 3, 1899, c. 425, the same act in question here, directing an alteration in a bridge, must be obeyed, and obeyed without compensation, although the bridge had been built in strict accord with an Act of Congress declaring that if so built it should be a lawful structure. (*Louisville Bridge Co.* v. *United States*, 242 U. S. 409, 417; *Greenleaf Johnson Lumber Co.* v. *Garrison*, 237 U. S. 251.) It only remains to consider what the United States has done. And it will be as well to bear in mind when considering it that this suit is not for the purpose of doing away with the channel, which the United States, we have no doubt, would be most unwilling to see closed, but solely for the purpose of limiting the amount of water to be taken through it from Lake Michigan.

Legislative History—The defendant in the first place

refers to two acts of Congress; one of March 30, 1822 (3 Stat. 659), which became ineffectual because its conditions were not complied with, and another of March 2, 1827 (c. 51, 4 Stat. 234), referred to, whether hastily or not, in *Missouri* v. *Illinois*, 200 U. S. 496, 526, as an act in pursuance of which Illinois brought Chicago into the Mississippi watershed. The act granted land to Illinois in aid of a canal to be opened by the state for the purpose of uniting the waters of the Illinois River with those of Lake Michigan, but if it has any bearing on the present case it certainly vested no irrevocable discretion in the state with regard to the amount of water to be withdrawn from the lake. It said nothing on that subject. We repeat that we assume that the United States desires to see the canal maintained and therefore pass by as immaterial all evidence of its having fostered the work. Even if it had approved the very size and shape of the channel by act of Congress it would not have compromised its right to control the amount of water to be drawn from Lake Michigan. It seems that a less amount than now passes through the canal would suffice for the connection which the United States has wished to establish and maintain.

In an appropriation Act of March 3, 1899 (c. 425, Sec. 10; 30 Stat. 1121, 1151), Congress provided "That the creation of any obstruction not affirmatively authorized by Congress, to the navigable capacity of any of the waters of the United States is hereby prohibited; . . . and it shall not be lawful to excavate or fill or in any manner to alter or modify the course, location, condition, or capacity of any port, roadstead, haven, harbor, canal, lake harbor or refuge or inclosure within the limits of any breakwater, or of the channel of any navigable water of the United States, unless the work has been recommended by the Chief of Engineers and authorized by the Secretary of War prior to beginning the same." By Sec. 12 violation of the law is made a misdemeanor and punished, and the removal of prohibited structures may be enforced by injunction of the proper court of the United States in a suit under the direction of the Attorney General. This statute repeatedly has been held to be constitutional in respect of the power given to the Secretary of War. (*Louisville Bridge Co.* v. *United States*, 242 U. S. 409, 424.) It is a broad expression of policy in unmistakable terms, advancing upon an earlier Act of September 19, 1890 (c. 907, Sec. 10; 26 Stat, 426, 454), which forbade obstruction to navigable capacity "not authorized by law," and which had been held satisfied with regard to a boom across a river by authority from a state. (*U. S.* v. *Bellingham Bay Boom Co.*, 176 U. S. 211.) There is neither reason nor opportunity for a construction that would not cover the present case. As now applied it concerns a change in the condition of the lakes and the Chicago River, admitted to be navigable, and, if that be necessary, an obstruction to their navigable capacity (*United States* v. *Rio Grande Dam & Irrigation Co.*, 174 U. S. 690), without regard to remote questions of policy. It is applied prospectively to the water henceforth to be withdrawn. This withdrawal is prohibited by Congress, except so far as it may be authorized by the Secretary of War.

War Department Permits—After this statute was passed the Secretary of War granted various permits, which are relied on by the appellant although in their nature they all were revocable licenses. On May 8, 1899, the secretary, on application of the appellant, granted permission to open the channel, assumed in the recitals to have a flowage capacity of 300,000 cu.ft. per min. with a velocity of one and one-quarter miles an hour, on the conditions that the permit should be subject to the action of Congress (which was superfluous except as a warning); that if at any time the current created proved to be unreasonably obstructive to navigation or injurious to property he reserved the right to close or modify the discharge; and that the Sanitary District must assume all responsibility for damages to property and navigation interests by reason of the introduction of a current in Chicago River. On July 11, 1900, improvements of the Chicago River were permitted with the statement that the permission did not affect the right of the Secretary to revoke the permit of May 8, 1899. On April 9, 1901, the Secretary, Mr. Root, directed the Sanitary District to cut down the discharge to 200,000 cu.ft. per min. On July 23, 1901, at the appellant's request, he amended the order to permit a flow of 300,000 ft. between 4 p.m. and twelve, midnight, subject to revocation. On December 5, 1901, again on the application of the appellant, leave was given to discharge not exceeding 250,000 feet per minute during the whole twenty-four hours, but subject to such modification as the Secretary might think that the public interest required. On January 17, 1903, the allowance was increased to 350,000 feet until March 31, 1903, after which date it was to be reduced again to 250,000 feet, all subject to modification as before. On September 11, 1907, and on June 30, 1910, permissions were granted to make another connection with Lake Michigan and to open a channel through Calumet River (this last refused by Mr. Secretary Taft on March 14, 1907) on the understanding that the total quantity of water withdrawn from the lake should not exceed that already authorized by the Secretary of War. Finally on Feb. 5, 1912, the appellant, setting forth that the population of the Sanitary District exceeded 2,500,000 and was increasing rapidly, and that the only method then available for disposing of the sewage of this population was by diluting it with water flowing from Lake Michigan through the canal, asked permission to withdraw not exceeding 10,000 cu.ft. per sec., subject to such restrictions and supervision as might seem proper to the Secretary and to revocation by him. On Jan. 8, 1913, Mr. Secretary Stimson carefully reviewed the situation, including the obvious fact that so large a withdrawal would lower the levels of the lakes and the overwhelming evidence that it would affect navigation, and held that he was not warranted in excepting the appellant from the prohibition of Congress on the ground of even pressing sanitary needs. It appears to us that the attempt to found a defense upon the foregoing licenses is too futile to need reply.

Rights and Claims—States bordering on the Mississippi allowed to file briefs as *amici curiae* suggest that they were not heard and that rights have not been represented before the Secretary of War. The city of Chicago makes a similar complaint and argues that it is threatened with the loss of a hundred million dollars. The interest that the river states have in increasing the artificial flow from Lake Michigan is not a right, but merely a consideration that they may address to Congress, if they see fit, to induce a modification of the law that now forbids that increase unless approved as prescribed. The investment of property in the canal and the accompanying works took the risk that Congress might render it valueless by the exercise of paramount powers. It took the risk without even taking the precaution of making it as sure as possible what Congress might do. But we repeat that the secretary by his action took no rights of any kind. He simply refused an application of the Sanitary Board to remove a prohibition that Congress imposed. It is doubtful at least whether the secretary was authorized to consider the remote interests of the Mississippi States or the sanitary needs of Chicago. All interests seem in fact to have been copiously represented but he certainly was not bound to give them a hearing upon the application upon which he was requested to pass.

After the refusal, in January, 1913, to allow an increase of flow, the appellant was notified by direction of the War Department that it was drawing more water than was allowed and was violating Sec. 10 of the Act of March 3, 1899. In reply it intimated that it was bound by the state law to which we have referred and in obedience to it had been flowing 20,000 cu.ft. per min. for each 100,000 of population and could not reduce that flow.

It suggested that its rights should be determined by a suit, and accordingly this bill was filed October 6, 1913. An earlier suit had been brought on March 23, 1908, to prevent the construction of a second channel from Lake Michigan through the Calumet River to the appellant's main channel, leave to do which had been refused as we have seen by Mr. Secretary Taft. (The permit subsequently granted on June 30, 1910, was with the understanding that it should not affect or be used in the "friendly suit" then pending to determine rights.) The earlier suit was consolidated with the later present one, and it was agreed that the evidence taken in that should be used in this, so far as applicable. There was some delay in concluding the case, which the defendant naturally would desire, but after it was submitted to the judge according to his own statement he kept it about six years before delivering an oral opinion in favor of the government of June 19, 1920. No valid excuse was offered for the delay. There was a motion

for reconsideration, but the judge took no further action of any kind until he resigned in 1922. On June 18, 1923, another judge entered a decree for an injunction as prayed, with a stay of six months to enable the defendant to present the record to this court.

Injunction Affirmed—The parties have come to this court for the law, and we have no doubt that as the law stands the injunction prayed for must be granted. As we have indicated a large part of the evidence is irrelevant and immaterial to the issues that we have to decide. Probably the dangers to which the city of Chicago will be subjected if the decree is carried out are exaggerated, but in any event we are not at liberty to consider them here as against the edict of a paramount power.

The decree for an injunction as prayed is affirmed, to go into effect in sixty days—without prejudice to any permit that may be issued by the Secretary of War according to law.

Restoring a Steel Bridge After Landslide Movement

Structure Moved 2.6 Ft. Lengthwise by Hillside Slip—Pier Tops Rebuilt in New Location After Jacking Up Span

By E. K. Triol
Bridge Construction Engineer, Seattle, Wash.

THE TWELFTH AVENUE South Bridge in Seattle is a steel three-truss cantilever structure 361 ft. long (central span 171 ft., side spans each 95 ft.) In February, 1917, a heavy landslide struck the south end of the bridge and shifted it bodily along its axis a distance of 2 ft. 6 in. to the north. Further movement was prevented by the collision of the north end with the north bank, fortunately just in time to keep the shoes from going off the piers. As it was, the shoes were

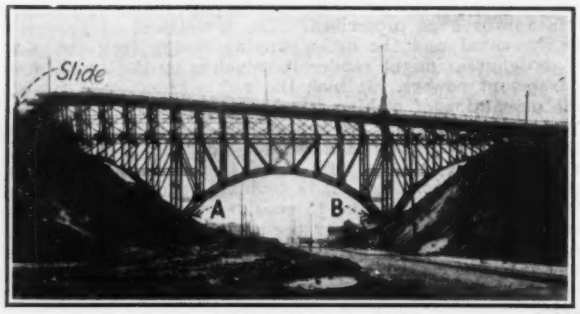


FIG. 1—BRIDGE IMMEDIATELY AFTER SLIDE
Landslide on left-hand slope crowded against the end of the bridge and shoved the structure to the right. All jacking was done at A and B.

dangerously close to the edges of the piers, but the bridge sustained no damage that could not be repaired.

New pier tops were built in the new location of the bridge, as soon as the structure could be raised off the damaged supports and restored to level. Since the repair the structure has been in use continuously, and the slide has been removed as part of a regrading project in which the entire hillside adjoining the south end of the bridge was terraced by hydraulic sluicing.

At the time of the damage the bridge carried a temporary inclined deck at some height above the top chords (see Fig. 1), on which the roadway was carried pending the completing of the regrading project. Exclusive of this decking the bridge weighed 600 tons, of which half was supported on each set of three main piers.

On account of the shifting ground at the south end and the danger of further slides following the one that

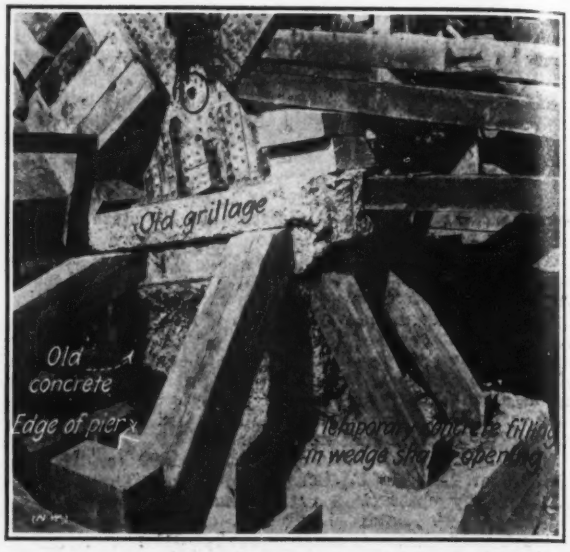


FIG. 2—SHOE HANGING PRECARIOUSLY OVER PIER EDGE
Laitance at a construction joint destroyed the bond and a piece of the pier top slid with the grillage toward edge of pier. Timbering shown is shoring put in before blocks for jacking were placed.

moved the bridge, it was decided not to attempt to move the structure back to its original position but instead to strengthen and maintain the timber cribbing which had been put in hastily immediately after the accident to prevent further displacement, and then to raise the structure and hold it on temporary supports until new bearings could be prepared under it. In following this program an important problem was the selection of the most advantageous point in the bridge at which to apply the lifting stress. The plan adopted was to rivet diaphragms of plates and angles to the webs of the posts over the main piers, and by means of I-beams and timbers to jack up against the bearing thus provided.

At each main pier four 25-ton ball-bearing jacks were

FIG. 3—JACKING OPERATIONS UNDER WAY
The truss reaction is transferred to the jacks by needle beams bearing against a diaphragm riveted to the web of the pier vertical.

used on each outer truss and four 50-ton jacks were used on the middle truss; and as one end of the bridge was raised at a time, 12 jacks were required for the entire job. A man was stationed at each of the 12 jacks, and the movement of the bridge was watched carefully so as to keep the lifting stress distributed as nearly uniformly as possible. The south end of the bridge was lifted first and when this was securely blocked up and shored the north end was lifted.

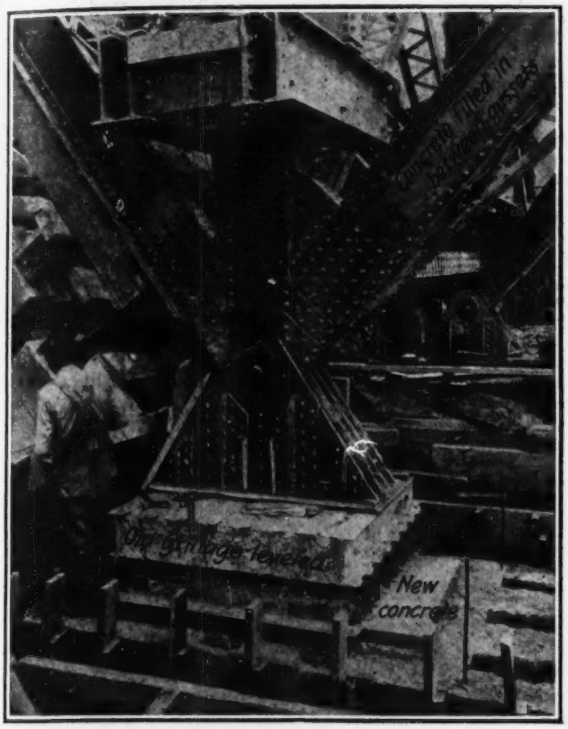


FIG. 4—SHOES AND SUPPORTS AFTER REPAIRS
Jacks have been removed and new concrete is supporting releveled grillage. Coping not yet poured. This view shows the shoes of all three trusses at the north end of the bridge.

Careful check of the span lengths and levels on the pins made previous to the lift showed that the bridge had been deformed but little by the tremendous force of the slide and would adjust but a fraction of an inch longitudinally when free to take its normal position. This proved to be correct; plumb bobs hung from the steel over points on the piers showed slight readjustment.

The bridge was free to move laterally at the time of jacking and the entire weight was on the relatively small bearing of the jacks, which had but little stability against overturning. A system of four inclined transverse struts was therfore added to the timbering to prevent a side slip that might have resulted disastrously. As the jacking progressed these struts were wedged up tight from time to time to prevent any loosening of lateral movement.

Before starting the jacking the speed of the two sizes of jacks was compared; it was found that three strokes of the handle on the 50-ton jacks would give the same movement as two strokes on the 25-ton jacks. By following this ratio in the jacking a uniform rate of lifting was secured. In a period of two hours the bridge was raised eight inches. Here it was held on the timber blocking for seven days while the old shoes and grillages were leveled up, new concrete poured and given time to set. New concrete added to the piers on the north side from footings to copings had already set for some time. Setting of the coping was hastened by covering the concrete with water kept warm by means of a steam line from a nearby boiler. The new footings consisted of an addition to the original piers extending the area of their tops enough to afford adequate bearing for the old grillages. When the bridge was lowered onto the new supports holes were drilled in the new concrete and anchor bolts grouted in place.

The work was done by the city engineering department forces under A. H. Dimock, then city engineer, the late F. A. Rapp, bridge engineer, and the writer, at that time superintendent of bridge construction.

N. Y. Barge Canal Is Expensive Luxury

IN HIS ANNUAL message to the legislature Governor Alfred Smith, of New York, gives some hitherto unpublished figures on the total cost of the state's Barge Canal and the freight that is carried thereon:

It is interesting to review some figures in connection with the old Erie Canal: The total cost of construction, repair, maintenance and operation from the day it was opened to 1883 was $78,862,154. Up to 1883 tolls were collected on the canal and in that same period the state received revenue in tolls $121,461,871, bringing a net profit to the state of $42,599,718.

Between 1883, when the tolls were abolished, and 1899 about $22,000,000 was expended on the canal, so that there remained at the beginning of the construction of the so-called Barge Canal in 1904 a balance to the credit of the Erie Canal of a little over $20,000,000.

Interesting also is the history of the tonnage carried on the old Erie Canal by comparison with the new Barge Canal. Taking the six years prior to the abolition of the tolls—from 1877 to 1882—32,593,646 tons of freight passel through the old Erie Canal, or an average yearly of 5,434,474 tons. The new Barge Canal was really not opened for operation until 1919. Taking the six years from 1919 to 1924, we have 9,842,884 tons of freight carried, or a yearly average of 1,640,481 tons, although the Barge Canal was designed to carry four times the freight of the Erie Canal.

The Barge Canal, including construction, terminals, grain elevators' repairs, maintenance, operation and payment of claims for damages has cost the people since 1905 up to date $191,000,625.91; between 1905, when the first canal bonds were sold, up to 1924, inclusive, we have paid in interest $39,880,386.73, making the total cost of the Barge Canal to date $230,881,013.64.

Let us look for a moment at the figures on the four branches of the canal for 1924. Cayuga and Seneca carried 10,827 tons, Champlain 311,470 tons, Erie 1,691,766 tons, Oswego, 18,254 tons, making a total tonnage for the operating season of 1924 of 2,032,317 tons. At this point let me make an observation about the operation of the Oswego Canal. Maintenance and operation of that branch during 1924, exclusive of permanent betterments and improvements, was $80,619.70, which is the cost of handling the freight carried on this branch, without taking into consideration overhead, interest on bonds, etc., the cost per ton carried being $4.41.

To complete the canal to a point that would make unnecessary the enormous annual expenditures for dredging, complete the terminals, remove sharp bends that interfere with navigation, and do other essential things will cost approximately $16,606,000. I am further informed at the office of the Attorney General that there are pending against the state 751 claims for damage to water rights and privileges, appropriation of lands and so on, the face amount of which is $23,892,472.62.

I suggest that the Legislature create a temporary state commission, to be made up of members of the legislature and some appointees of the governor, to conduct a study of the whole operation of the canal, comprehended in which should be a study of its possibilities and what the state can do to promote its usefulness.

Modern Road Engineering Presents Broad Aspects

Superhighways Are an Imminent Problem—Radical Changes Appear in Brick Road Design—Quick-Setting Concrete Comes to Front—Smoothness Accentuated

A cross-section of the growing breadth of highway engineering was presented in the papers read at the annual convention last week in Chicago of the American Road Builders' Association. Traffic development and determination, engineering research, the planning of superhighways, the technic of construction and maintenance and the development of riding comfort were all included in the highway engineer's task. This vision lends especial interest to the abstracts of the papers which are given here and will be continued in future issues.—EDITOR.

This article should be read in connection with the article in this group on superhighways. The two outline a plan of highway development which is striking in its far-sighted conception of today's planning for tomorrow's highways.

Fitting Old Roads to New Traffic

BY EDWARD N. HINES
Chairman, Board of Wayne County Road Commissioners, Detroit, Michigan

THERE ARE 450 miles of improved roads in Wayne County, Michigan. Of this mileage 375 miles are concrete roads and 65 miles of concrete roads are planned for construction in 1925. Improvement began in 1906. As in most other communities the original demand was for mileage. Against the judgment of the commissioners, who wanted 18-ft. concrete pavement, many miles of 12, 15 and 16-ft. concrete roads were built. With the multiplication of motor vehicles the problem was to fit the old roads to the new traffic.

Aside from the fact that the highways were becoming crowded, we were confronted with rapidly increasing maintenance charges on the shoulders of the roads outside of the paved strip. We then increased our minimum width of pavement to 20 ft., with shoulder widths of not less than 5 ft. on each side, making a 30-ft. width over all. We also commenced to widen all concrete pavement previously constructed of a lesser width than 18 ft. All of this widening of old roads increased their width to 20 ft. or more.

Additional width of pavement alone of course would have been ineffective without adequate bridges. Therefore, the load capacity of bridges was increased to a 24-ton live-load, and the clear roadway width to a minimum of 27 ft. A T-beam and slab type bridge with a precast ornamental hand rail was planned. This type lends itself to future widening with a minimum of interference to traffic and with little loss of the first investment in the structure.

It was realized that rights-of-way are fundamental. Groping around in the effort to correct and relieve traffic congestion, the commission has for several years past been acquiring additional rights-of-way widths, particularly on the arterial roads out of Detroit. The first goal in this respect was the acquirement of a right-of-way of 100 ft. on such radial roads as Woodward and Michigan Avenues, Grand River Road and others. On these, double concrete roadways have been constructed, separating traffic lines and providing for electric interurban tracks in the center. On roads where there were no tracks to provide for there have been built in some cases 40-ft. pavements without the center track zone.

The traffic capacity of any such highway system as this, which is more or less a gridiron of north and south and east and west roads with a few radial arteries, is limited to the volume that can be passed by the intersections. Therefore, much attention was devoted to the width and layout of pavements near intersections. The radii of the connecting turns at intersections was increased to a minimum of 60 ft. and the minimum paved width of highway is 40 ft. for a distance of 200 ft. on each side of the intersection. This necessitated, in most cases, the purchase of additional property from the corners of adjacent fields. In some cases the roadway was divided into long radius turns running in each direction to join an intersecting road.

At all of these intersections, also at crossings of railway and trolley lines, flashing signals were installed which warn the motorist unmistakably that he is approaching a point where he must drive with caution. The installation of these signals has eliminated accidents, both fatal and non-fatal, up to date at road intersections. The widening of the pavement and the installation of the long-radius turns speeded up traffic at the intersections to a considerable extent, particularly on those days when the traffic volume was large.

* * *

Three practicable methods of increasing subgrade stability are enumerated. The paper should be read in conjunction with the paper in this group on thinning down brick wearing surfaces.

Stabilizing Subgrades for Brick Pavements

BY WILLIS D. P. WARREN
Holbrook, Warren & Van Praag, Civil Engineers, Decatur, Illinois

WHILE it is fully recognized that peculiar local conditions will greatly affect the design of a brick pavement, in general it will be found that economical construction can be accomplished only when full realization is had that the function of the subgrade is to carry the weight and impact of traffic, as imparted to it through the superimposed wearing surface, and particularly is this true on highway construction. It is proposed in the following discussion to emphasize the fact that it is both entirely feasible and economical to design a brick pavement foundation on the basis of this theory.

The report of the National Research Council under date of May, 1923, contains the following interesting statement: "If it is true that a soil of low moisture content offers better support than one of higher percentage of moisture, methods must first be evolved by which moisture content can be stabilized. After these methods have been perfected their cost must be compared with that of additional thickness of the road necessary to overcome the faults of the subgrade without treatment, to determine whether, economically, it is advisable to treat the subgrade or increase the strength of the slab."

The essential point established by recent tests is that the percentage of capillary moisture can be very substantially reduced by increasing the difference in elevation between the highway subgrade and the side ditches or tile drains. In other words, deeper side ditches or deeper tile drains is one answer to this problem, provided such increased depth be economically accomplished.

It is desired to emphasize a fact that should be kept clearly in mind in this connection, and this fact is that the reduction rather than the elimination of capillary moisture is the end sought, and that it is the percentage rather than the mere presence of such moisture which determines the stability of the subgrade.

Another method of improving the subgrade is to prevent the rise of capillary moisture by spreading non-capillary materials over or under the same. Sand, gravel and soil admixtures such as lime, portland cement, etc. are helpful in creating over a bad subgrade a layer which has high

bearing value. Also admixtures of water-gas and tar are somewhat helpful. Considering the cost of all these various methods, it will in general be found that capillary moisture in the subgrade can be most economically and positively reduced by lowering the water table through the construction of deeper side ditches or tile drains. Taking into consideration the cost of adulterants, together with the cost of moving the necessary additional earthwork over the area of the ordinary roadway, it is quite probable that there will be less expense attached to the necessary deepening of the side ditches, although the economical method to be used will depend upon the particular local conditions and prices.

A third method of increasing and maintaining the stability of the subgrade is to construct impervious cutoff walls along the sides of the pavement slab. Such walls may be constructed of any convenient and inexpensive material, and should extend downward from the bottom of the marginal curbing (or be constructed integral with such curbing) to a depth about equal to that of the side drains. Ordinarily impervious cutoff walls would need to extend about 2 ft. below the bottom of the marginal curbing or to a depth equal to the depth of the side drains, depending somewhat on the nature of the subgrade materials. Such cutoff walls should have a width of three or four inches, and the trenching should ordinarily be done with a tile spade or similar tool. Estimates show that where composed of very lean mixture of concrete, or of bituminous mixtures such as one part Tarvia B or cut-back asphalt to ten parts sand they should be built at a cost somewhat below the cost of one inch of additional concrete in the concrete foundation.

The construction of impervious cutoff walls to the level of the bottom of the side drains will not necessarily prevent the rise of a small percentage of capillary moisture in the subgrade above the horizontal plane of the side drains, but their construction will effectually serve to prevent the free passage of surface water and capillary moisture from the road shoulders to the subgrade, above the horizontal plane of the side drains. By the construction of side drains of proper depth, the percentage of capillary moisture in the subgrade is reduced, and by the construction of impervious cutoff walls under the edges of the pavement slab this reduction of the percentage of capillary moisture is maintained. It is as vitally important in establishing a stable subgrade that a low percentage of moisture be maintained in the subgrade materials, as that a high percentage of moisture shall be reduced in such subgrade materials.

Over and above these considerations which are of fundamental importance, the construction of impervious cutoff walls is justified in many soils by reason of the fact that they will prevent the lateral displacement of the subgrade. In other words the construction of such cutoff walls will serve to provide a confined subgrade.

* * *

Here and there where roads are being designed new for intensely heavy truck traffic we find some notable examples of expensive construction. Such is the short road described by Mr. Robbins.

High-Cost Highway for Terminal Traffic

By Harry D. Robbins
Division Engineer, New Jersey Highway Department, Trenton, N. J.

THE TRAFFIC which this road carries might be termed terminal traffic, for it is the main highway between New York City and Philadelphia, and over it must go those great highway transports which ply between these busy terminal cities. Further, between New York and Philadelphia lie such important municipalities as Jersey City, Newark, New Brunswick, Trenton, and Camden, and travel from and to these points is far from small.

When plans were made for the reconstruction of this road which is 4.98 miles long, it was decided not only to build a high type of pavement, but also to improve all alignment where necessary, so as to eliminate every dangerous curve.

Detailed attention was paid to drainage, and 10,000 lin.ft. of storm drain and 13,400 ft. of underdrain were installed. Two old bridges along the route were replaced with modern structures. At several points there were spongy portions in the subgrade. These were eliminated by the addition of 700 cu.yd. of cinders as sub-base, carefully rolled and consolidated. The work also required the relocation and paving of about one mile of trolley track. The maximum grade before construction, 7 per cent, was reduced to 5.5 per cent. The maximum curvature was reduced from 15 deg. to 8 deg.

Two line reinforced concrete, 10 in. thick, and of 1:1½:3½ mix, comprised the new surface on 19,230 sq.yd. on grades up to 5.5 per cent. Sheet asphalt, with 1½-in. binder and a 1½-in. top, on an 8-in. plain concrete base, 1:3:5 mix, was laid over 50,371 sq.yd. on grades up to 3.78 per cent. Granite block with asphalt filler, on 6-in. concrete base, was laid on 4,482 sq.yd. between trolley tracks. The width of the concrete surface is 30 ft., the sheet asphalt from 20 to 30 ft. and the granite block 9 ft.

The total cost was $515,000, exclusive of bridges, plus a charge of 3¼ per cent for field engineering and inspection.

* * *

The notable thing about the concrete road patching described is that the quick-setting concrete is not an alumina cement concrete but the much cheaper standard cement concrete made quick-setting merely by emphasizing the conditions that promote setting activity.—Editor.

Quick Hardening Concrete Patches for Old Roads

By A. H. Hinkle
Superintendent of Maintenance, Indiana State Highway Commission, Indianapolis, Ind.

WHERE OLD concrete road surfaces have failed because of base failures it has been the custom generally in the past to patch such places with a bituminous mixture. This has been done because the great time required to permit patches made of portland cement concrete to harden closed the road to traffic for too long a time.

CUTTING OUT OLD CONCRETE FOR PATCHING
This portable compressor outfit can be quickly run from place to place and has proved one of the most useful tools in the department's outfit of equipment.

Because of the availability of the old concrete road as a foundation for a new surface of some type, it is desirable to patch the old road where base failures have occurred with portland cement concrete so as to make it as stable as the remainder of the surface. Such concrete patches may also reclaim the old surface for traffic without a resurfacing.

It has been demonstrated that concrete patches can be made by a proper mixture of concrete made of portland cement, which patches can be opened to traffic after two, five, seven or more days, depending upon the concrete mixture used. This quick hardening concrete made of the ordinary portland cement depends for its quick strength upon: (1) richness of the mix; (2) coarse and properly graded sand; (3) freedom from excess water; (4) use of

FINISHING THE CONCRETE PATCH

Care and skill have to be exercised or the patch will be out of surface with the adjoining road.

calcium chloride; (5) high atmospheric temperatures. We have made concrete patches this past year which were opened to heavy truck traffic two days after they were made and which show no signs of being injured by the heavy traffic.

While the new cement known as alumina cement can be used to make a patch which can be opened to traffic one day after being laid, the cost of this brand of cement is at the present time such as to make such patches more costly than when made with the quick-hardening concrete made of ordinary portland cement described above.

* * *

The tradition that a brick pavement must be four inches thick has been given some hard knocks by practice in recent years. The author of this paper roundly asserts that, except for the heaviest traffic, brick pavements should be always at least an inch thinner.

Thinning Down Brick Wearing Surfaces

By Willis D. P. Warren

Holbrook, Warren & Van Praag, Civil Engineers, Decatur, Ill.

APPARENTLY, since those building roads provided a depth of 4 in. in the wearing surfaces of our early brick pavements, many authorities refuse to recognize any depth less than 4 in. as being sufficient to provide the necessary qualities required in such wearing surfaces. Regardless of the changed character of the foundation, regardless of the improved cushion provisions, regardless of the improved wearing and waterproof qualities of the filler, and regardless of the better wearing qualities of the individual brick itself, there is still hesitation on the part of some authorities to recognize the fact that true economy in brick pavement construction can be accomplished only when full recognition is given the changed characteristics of these various component parts of the whole pavement structure.

Recent investigations point to the interesting conclusion that there is now a strong tendency to specify brick of 2½ and 3-in. depths, in preference to brick of 3½ and 4-in. depths. In fact a very substantial yardage of paving brick of only 2½-in. depth is now being used, although in general there seems to be a preference for the 3-in. brick. Experience has demonstrated that a three-ton roller will have highly satisfactory results in the rolling of brick of 2½ and 3-in. depths. Such bricks are widely used in the south and southwest and they are being manufactured and sold in Ohio, Illinois and other northern states.

Considering all the above mentioned facts, it is recommended that a paving brick having a depth of 2½ in. be adopted as standard for all traffic except the very heaviest, and that for this latter class of traffic a depth of 3 in. be adopted as standard. Both tests and experience confirm the desirability of this change from present standards; and in view of the further advantages to be derived in the matter of repair and maintenance, and in particular in the matter of the resurfacing of old pavements of various types, it is quite certain that the general use of a 2½-in. paving brick is demanded under existing conditions and requirements.

* * *

As a preface to this notable proposal the article in this group on fitting old roads to new traffic should be read carefully. A preliminary description and general map of this scheme were published in *Engineering News-Record*, June 24, 1924.

Wayne County Plans Super-Highways

By Edward N. Hines

Chairman Board of Wayne County Road Commissioners, Detroit, Mich.

IN CONJUNCTION with the Detroit Rapid Transit Commission and the authorities of the adjacent counties, all of the territory lying within a 15-mile radius from the Detroit City Hall is being mapped, and thereon has been laid a scheme of thoroughfares which some one has been pleased to designate as superhighways. Every three miles, a right-of-way 204 ft. wide is being secured. The radial main arteries which are of greater importance than the meridian roads since they have no main parallel highways, are also to have the 204-ft. width. Between these superhighways there will be at every mile a road built upon a right-of-way of 120 ft. On the half-mile lines the width of right-of-way will be 86 ft.

The half-mile or 86-ft. rights-of-way will have two pavements, each 20 ft. wide, with a center zone of 20 ft. for interurban traffic. The remaining 26 ft. provides a 13-ft. strip on each side for walks, shoulders, and parkways. Upon the 120-ft. right-of-way, there will be a central pavement having a minimum width of 40 ft. to accommodate high-speed traffic. The lanes for traffic in opposite directions will be divided only by suitable markers. Outside of this high-speed zone there will be a 5-ft. parking strip and next a 20-ft. pavement for motor parking, local and slow speed traffic. At the margins there will be a 15-ft. space for shrubbery and sidewalks. This arrangement requires a total width of 120 ft. On the superhighways at three-mile intervals there will be added to the 120-ft. width, just described, a further right-of-way of 84 ft. for rapid transit rail facilities, including sufficient space for tree and shrub planting to screen these. The high-speed roadways, each 20 ft. wide, will then be arranged one on either side of the central 84-ft. zone. Outside of these express roadways, will be the 5-ft. planting or safety zone strip, then a 20-ft. roadway for motor parking and local traffic, and the 15-ft. sidewalk area. This makes a total of 204 ft. from property line to property line. The 120-ft. width is the same as has been planned for important radial streets. Its width is sufficient to permit the construction of a four-track rapid transit subway beneath without interference with the foundations of adjoining buildings. When the street reaches the outlying sections, the thoroughfare is split down one middle and each 60-ft. section is separated so that the rapid transit tracks may emerge from the subway until they reach the surface and occupy the 84-ft. space reserved in the center between the two 60-ft. sections, thus forming the 204-ft. superhighway.

At intersections of the 204-ft. superhighways there will be three levels. The local traffic will be carried at the same elevation as the adjacent property. One superhighway will be elevated to the necessary height above the local intersection while the other superhighway will be

depressed. At intersections of 204-ft. superhighways and the 120-ft. highways, there will be a two-level intersection with the narrower highway passing under the high-speed roadway and rapid transit sections of the wider highway, but meeting the local roadway at a new and partially depressed grade. The secondary thoroughfares on half-mile lines having the 86-ft. width will also cross below any superhighways in the same manner as the 120-ft. roads. The streets intersecting between the half-mile intervals will be stopped at the superhighway and their traffic will enter upon the local roadway and go to the first half-mile crossing point if it wishes to cross.

The important feature of this scheme is that at no point will there be interference to high-speed traffic from intersections. At suitable intervals there will be entrances from the local roadways to the express roadways which will permit a vehicle to leave the local or slow-speed roadway and merge with the high-speed traffic without danger or inconvenience.

Pedestrian subways will be provided wherever required by conditions so that this important traffic will be entirely segregated and can move without interference or danger.

Within a 15-mile radius from the Detroit City Hall, there will be 225 miles of these superhighways of which 44 per cent or about 100 miles will lie within Wayne County. The plan, however, is being carried further on certain important thoroughfares. For example, on Michigan Road, which is Detroit's principal artery to the west, the superhighway will be carried to the western boundary of Wayne County, a distance of about 28 miles from the center of Detroit. On another artery, Woodward Ave., which is our main thoroughfare to the northwest, there is already under construction a highway which approximates the scheme of the superhighway here previously described. The state of Michigan has this improvement already under contract and the grading has been practically completed. The width of this highway now under construction will be 200 ft. It has a central zone of 40 ft. for electric interurban lines, and two roadways each 44 ft. in width with low curbs. Outside of the paved areas there will be a strip of gravel surface and sufficient widths for sidewalks. The gravel surface will permit vehicles to withdraw entirely from the paved area to serve adjacent industries, to change tires, etc. Three miles on the southbound traffic side of this thoroughfare extending north from the city of Detroit have been completed and are now in use. The total length of this improvement from the Detroit city limits to the city of Pontiac is 16 miles. The grading on practically this entire distance has been completed and a number of miles of the curbs, which are being built separately, have also been constructed.

We are actively at work securing the necessary rights-of-way for this undertaking. The construction of the highways themselves will be a gradual process. At first only a portion of the ultimate paved width will be provided. As traffic increases the pavement will be widened, and finally when provision for express traffic becomes necessary, the roadways will be separated at the station points or the intersections. The question of construction, therefore, is not an urgent one.

There are still some important steps to be taken by the communities interested. The chief one of these will be a special act of the legislature creating a transportation district which will be endowed with the administrative authority to plan for financing the necessary rights-of-way. In order that no time may be lost Wayne County has not waited for the legislature, but has proceeded under existing laws as rapidly and steadily as those limitations permit. The Wayne County Road Commission has created a new department for this purpose. A member of the staff has been designated as special prosecuting attorney and is placed in charge of the acquisition and condemnation of rights-of-way. Property descriptions are being checked, cases prepared for court action where necessary, and every opportunity utilized to secure needed property when the chance offers. During the fiscal year just closed, over $800,000 was expended in acquiring rights-of-way, and in 1925 it is expected to invest upwards of a million dollars for similar purposes.

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Tests by profilometer show factors influencing degree of smoothness of concrete roads and lead to specifications regarding irregularities.

Pavement Smoothness Affected by Construction Methods

By H. F. Clemmer and D. D. McGuire
Engineers of Materials, Division of Highways, Springfield, Ill.

During 1924 a 32-wheel profilometer shown by Fig. 1 has been operated over approximately 75 miles of pavement, the investigation covering observations on 500 separate sections. Observations and profiles were made to include all the variable conditions of pavement construction in Illinois and comprised data on the work of 78 contractors. The equipment used in the construction by these contractors included five different makes of finishing machines and on a portion of the work, hand-finishing methods were employed.

In making a study of the various degrees of smoothness or roughness of pavement surfaces, the work has been conducted with particular reference to the irregularities which might affect the riding qualities of the pavement. In this study the following factors have been found to have an influence on the degree of smoothness:

1. The condition of the subgrade upon which the forms rest;
2. The condition of the forms;
3. The care used in setting the forms;
4. The condition of the finishing machine;
5. The operation of the finishing machine;
6. The consistency of the concrete;
7. The percentage of grade;
8. The degree of curvature.

The mechanical condition of the finishing machine as well as the manner in which it is operated are necessarily important in obtaining the smooth surface as results have shown.

One factor having a highly important effect on the ease with which a pavement may be finished successfully is consistency of the concrete. The placing of an extremely wet batch next to an extremely dry batch of concrete is certain to cause difficulty in the operation of finishing equipment

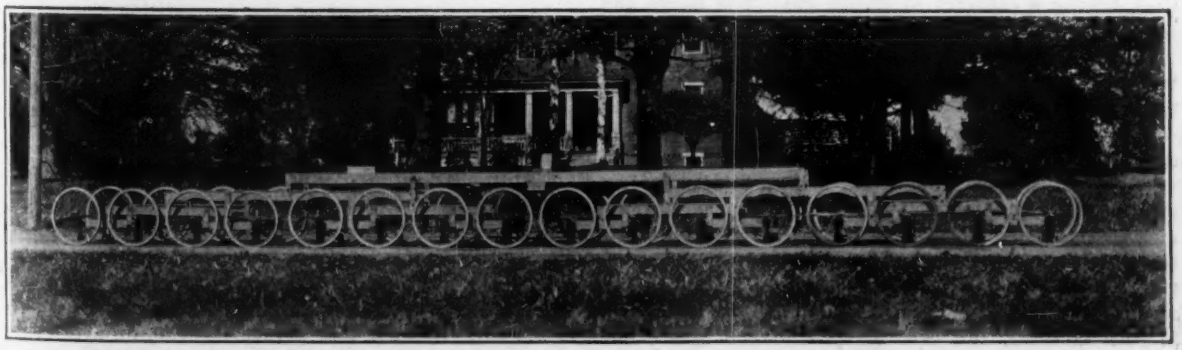


FIG. 1—PROFILOMETER FOR CHARTING ROAD SMOOTHNESS IN ILLINOIS

with the result of increasing the possibility of high spots. On curves and grades where concrete has a tendency to flow, finishing becomes difficult and as a result greater care is necessary to prevent irregularities. Observations taken on pavement on curves and grades show high spots in far greater number than anywhere else.

The Illinois highway specifications for finished concrete pavement allow no irregularities greater than ¼ in. from a 10-ft. straight-edge. All high spots in excess of this limit must be eliminated by the contractor with the use of a carborundum brick and water. If, however, the roughness cannot be reduced to specification limits by the above method without exposing the coarse aggregate, the Highway Department proposes to penalize the contractor for each high spot the cost of one square yard of pavement at the unit price as contracted, exclusive of the cost of cement.

Up to the first of this year high spots in excess of the specification limits (¼ in. in 10 ft.) were reduced by bush hammering. This method, however, has not proved satisfactory and will not be permitted in the future.

Fig. 2 shows the effect of grades of percentages varying

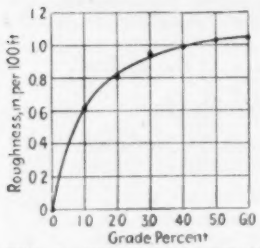


FIG. 2—EFFECT OF GRADE ON ROUGHNESS

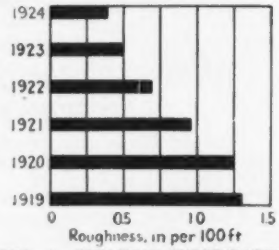


FIG. 3—YEARLY DECREASE IN PAVEMENT ROUGHNESS

from 0 to 6 per cent on the roughness of pavement surface. The roughness indicated in this chart is a summation of all irregularities over ¼ in. in 10 ft. and is an index of the riding quality of a pavement. The values used in the compilation of this data are those obtained on pavements constructed in Illinois in 1923 and 1924 and are given in inches per 100 ft.

Fig. 3 compares the surface roughness of pavements constructed in Illinois during each of six years beginning with 1919. The total roughness in this chart was obtained in the same manner as the value for roughness in the preceding chart. This comparison shows the progress made in Illinois in securing smooth pavement during the past six years.

A study of the investigation which has been obtained indicates that it is possible to secure a smooth pavement surface free from high spots by rigid inspection and strict enforcement of specifications. The observations made to study the surface smoothness obtained by various finishing machines indicates conclusively that any of the generally used machines in proper condition and in the control of competent operators can produce satisfactory results.

Welded Steel Oil-Tank Barge

An electrically welded steel barge built recently to carry oil for the Pennsylvania Petroleum Products Co. is 76x21 ft. and 11 ft. deep, built around two cylindrical oil tanks 8 ft. in diameter and 67 ft. long, each having a capacity of 26,000 gal. The barge and tanks have a total weight of 70 tons. The barge is divided into four compartments with three watertight bulkheads; oil will be carried in the two middle sections of the hull around the outside of the tanks, the end sections forming air or buoyancy chambers. In the construction of the barge, three electric welding equipments were used, one for tacking with a fitting-up crew and the other two for welding. The largest number of men used at any one time was six, while it is stated that for the ordinary riveted construction a force of eighteen men would have been required. As to relative cost, it is further stated that, excluding the costs common to both methods, two electrically welded barges could have been built for the price of one riveted barge.

Prizes Offered for Strain Gages and Vibration Recorders

A PRIZE competition for recording strain gages and vibration recorders is announced by the German Railway Co. The competition closes June 1, 1925. The award is to be made by a commission of five judges, all engineers, including one from the Federal Ry. of Switzerland. Three prizes ranging from 8,000 to 4,000 marks are offered for strain gages, and three prizes of 7,000 to 3,000 marks for vibration recorders. Existing instruments of these types are not believed to be satisfactory for determining the stresses and motions of bridges under moving trains.

It is considered desirable to attain a precision of about 0.001 mm., to obtain records free from distortion, to record stress variations ranging in speed up to 200 per second, and to record vibratory motions ranging from 200 to 1 per second. For this purpose the strain gage should have an internal period of vibration corresponding to a frequency of at least 800 per second. Pen friction must be minimized. The recorder should trace a zero line at the same time as the vibration line. A time record is to be provided and a manually controlled time pen is desired for marking the time of occurrence of particular load position or the like. The gage length should preferably be variable, but if fixed should not be longer than 8 in. The multiplication also should be variable. The instrument should be sensitive enough to permit of reading stress variations of 300 lb. per square inch at smallest gage length and smallest multiplication. The record strip should be wide enough to permit of recording stresses up to 30,000 lb. per square inch in either direction. The speed of the record strip should be variable between ½ in. and 4 in. per second. The record length need not exceed 65 ft. Remote-controlled starting and stopping is desirable. It is preferable to avoid photographic recording. It is desirable that the diagrams be read without magnification. Greatest flexibility of attachment to bridge members is desired, and if possible the strain measurement should refer to a fiber of the actual section.

The vibration recorder is to be of seismograph type, capable of recording horizontal and vertical vibrations. Its magnification need not exceed 25. A 2-in. width of record strip is considered sufficient. For recording vibrations the period of the instrument pendulum must be capable of adjustment up to a minimum of 28 seconds, but in case it proves possible to use the same instrument for recording deflections this period should be capable of increase to at least 10 seconds.

Instruments entered in the competition, together with all rights to their use, are the inventor's property.

In the announcement of the competition, issued by Drs. Hammer and Hülsenkamp of the Eisenbahn Zentralamt, Deutsche Reichbahn Gesellschaft, Berlin, the principal existing instruments of the two types in question are briefly reviewed as to their advantages and disadvantages.

Municipal Bonds Issued in 1924 Beat Record

Permanent improvements bonds issued by states, counties, cities, towns and districts in 1924, according to *The Bond Buyer*, totaled $1,400,000,000, $1,111,000,000 in 1923 and $1,383,000,000 in the previous record year, 1921. The total outstanding bonds in this class at the close of 1924 was $11,000,000,000, or five-sixths of the tax-exempt securities then outstanding.

Contractor or Constructor—An Open Discussion

Official of Guthrie & Co. Would Adhere to Old Title—Pennsylvania Contractors Offer Reason for Change

IN *Engineering News-Record*, Aug. 7, 1924, p. 234, reasons for changing the name of the Associated General Contractors to that of Associated General Constructors were advanced by H. H. Wilson, of Harrisburg, Pa. That letter and subsequent discussions have led Charles Ffolliott, chairman of the board of A. Guthrie & Co., Inc., contractors of St. Paul, Minn., to address an open letter to the profession. Mr. Ffolliott finds reasons which satisfy him that the name should stand as it is. Some of these reasons are abstracted herein. Mr. Ffolliott's letter has reached the attention of William D. Hill, past-president of the Associated Pennsylvania Constructors, who makes a reply. Part of Mr. Hill's remarks are also contained in the following paragraphs. The subject as to the proposed change will come up for consideration at the annual convention of the Associated General Contractors in Washington this week.

Mr. Ffolliott finds justification for retaining the name contractor by asserting that "we have been called contractors from the early dawn of civilization" . . . and by the fact that "the contractor is the man who undertakes to do a certain piece of work, complete it on time, fulfill all the terms and conditions of the contract and take the necessary risks involved in his part of the agreement. The word 'contractor' describes him fully and is more definite than the word 'constructor.'" Continuing, Mr. Ffolliott says:

"We contract for the same things as ever we did, we build railways, carry out public works, engage in the multiplicity of effort that a general contractor has always engaged in; we are dirt movers, pavers, bridge builders, wreckers of buildings, mine strippers, quarry men, etc., etc.

"Does the word 'constructor' describe our operations as well as 'contractor'? The former word has a very general application. The mechanic constructs machines, the box factory constructs boxes, the shipbuilder constructs ships, the mathematician constructs formulas, the lawyer constructs his defense in the law cases he undertakes to defend. If there is anything indefinite in the word contractor as applied to our business, it becomes more indefinite if we change to constructor. We do not get away from indefiniteness."

Referring to what he believes is an imputed desire in Mr. Wilson's original letter to get away from the obloquy by changing the name through "a surgical operation on the English language," Mr. Ffolliott finds that "if it is the alleged obloquy which some think the name contractor has acquired, is not the proposed change an admission of guilt and will it not do more to fix this obloquy in the public mind than by letting well enough alone?" Mr. Ffolliott likes the "time-honored name of contractor." He says that "We have been known as contractors for ages and under the name contractor great works have been built which are the glory of our age and will be of the ages to come."

Concluding, Mr. Ffolliott says: "Let us not make ourselves ridiculous in the eyes of our fellow men by such a foolish effort to rid ourselves of some fancied injury, or by a glorified use of a word to elevate ourselves in some mysterious way to a higher plane. Let us keep our feet on the ground."

Answering Mr. Ffolliott, Mr. Hill has the following to say:

Mr. Ffolliott outlines the remarks of Mr. Wilson regarding a considerable amount of adverse criticism incurred by the constructor through the shortcomings of others who are not constructors, because of the lack of a distinctive name, and then states: "Mr. Wilson proposes, by what he calls a surgical operation on the English language, to remove all this obloquy by changing the name of 'contractor' to 'constructor.'" There is nothing whatever in the text to indicate an opinion in Mr. Wilson's mind, that any such comparatively insignificant matter as a change of name would be a panacea for all unfair aspersions upon our craft.

Those who know Mr. Wilson realize that the success of his company under his leadership, the unsurpassed personal service rendered the A.G.C. and the Pennsylvania Chapter, his experience, character and intelligence make him far too practical a man to be possessed of any such hallucinations. The change of name was proposed by other members of the A.G.C (before Mr. Wilson became interested in same) upon the grounds that it would be a constructive move tending to give the man who builds architectural and engineering works a name which would be less confused with the activities of all other elements of business.

Mr. Ffolliott claims that the word "contractor" fully describes us and is more definite than the word "constructor." Let us see. The Standard Dictionary defines "contractor" as "a party to a contract, covenant or treaty." Webster says: "One who contracts, a party to a bargain." That is certainly not specific, as it covers both parties to a contract. The Standard Dictionary defines "constructor" as "one who constructs, a builder." This last definition is certainly far more specific and satisfying than either of the others quoted. While it is true, as he points out, that others beside our craft construct, it is also true that "contractor" is a much broader term than "constructor" since, as has been stated, "every business man, every employer, and all who sell commodities or services, or who enter into agreements of any kind, are engaged in the contracting business." If this be true, all human beings are contractors and the word has no fundamentally definite meaning as applied to any particular class concerned with social or industrial activity.

Mr. Ffolliott states that the mechanic constructs machines, the box factory constructs boxes, the mathematician constructs formulas, etc. He does not point out, however, that no one calls these people constructors, nor even builders, that term being generally considered to mean a constructor of houses. . . .

In promoting the new word "constructor" to our craft, through its use by the A.G.C., it may not be vain after all to hope that it will carry with it some of the prestige for the best things in the art of constructing, which have already come to be associated with that organization in the public mind.

Is not the practically unanimous judgment of the executive and advisory boards and president's council of the A.G.C., containing men who have devoted their thought, treasure and time to its upbuilding, worth something in this matter? Why does the world-wide firm of Dwight P. Robinson & Co., and hundreds of others of our craft now use "constructor" on their letter heads, signs and advertising to designate themselves? Doesn't it indicate that they feel the need for a new name? We will not make ourselves ridiculous by elevating our thoughts and deeds to a higher plane, and our fellow men will be the first to realize and acknowledge the effort.

Iowa Road Maintenance Costs

Exclusive of administrations and additions or betterments highway maintenance costs on the Iowa primary system in 1924 were as follows:

Class of Road	Mileage	Total Expenditure	Average Expenditure Per Mile
Earth	3,993	$1,354,538	$339
Gravel	2,164	1,149,333	531
Paving	502	73,517	146
Total	6,660	$2,577,388	387

The above maintenance may also be classified as follows:

Patrol	$1,468,445	Average	$220
Gang	753,330	Average	113
Equipment and tools	355,615	Average	53

Engineering Literature

A MONTHLY REVIEW OF BOOKS AND A LISTING OF NEW PUBLICATIONS

Doctor Swain's Monumental Treatise

REVIEWED BY W. K. HATT
Head, School of Civil Engineering, Purdue University, Lafayette, Ind.

STRUCTURAL ENGINEERING: Vol. I, Strength of Materials. Vol. II, Fundamental Properties of Materials—By George Fillmore Swain, LL.D., Gordon McKay Professor of Civil Engineering in Harvard University; formerly Chairman of the Boston Transit Commission and Consulting Engineer of the Massachusetts Railroad Commission; Past President Am. Soc. C. E.; M. Inst. C. E., Am. Soc. M. E., Eng. Inst. of Canada, Am. Soc. T. M., Am. Ry. Eng. Assoc., etc. New York and London: McGraw-Hill Book Co., Inc. Cloth; 6x9 in. Vol. I., pp. 569; 469 line cuts and halftones, $5. Vol. II., pp. 200; 49 line cuts. $2.50.

The training and experience of Dr. Swain have fitted him for the preparation of this monumental four-volume treatise, of which the first two volumes are now available. Completion of his technical schooling at the Royal Polytechnic School of Berlin; long experience as a teacher of engineering students; association with college faculties, with men of affairs, and eminent engineers of the United States, especially New England, a region which has been the early source of advances in scientific engineering; an active participation in the affairs of technical organizations, of one of which, the Am. Soc. C. E., he has been the president; service as a renowned practitioner, notably as consulting engineer of the Massachusetts Railroad Commission, and chairman of the Boston Rapid Transit Commission; a practised writer of books, technical articles, and papers of stimulating interest in the field of education—such is the equipment that has been brought to the preparation of this work. The present two first volumes are to be followed by a third completing the theory and design of simple structures of wood, metal, and masonry; the fourth will treat of more complicated and statically indeterminate structures.

Judging by the organization and tone of the first two volumes, the needs of the student, the teacher and the progressive practitioner will be met. The teacher may expect to have available a unified course in structural engineering, beginning with the fundamentals of the junior year, and continuing to courses in design of the senior year, with abundant material for subsequent graduate study. The author indicates those portions of Vol. I suitable for a shorter course. The student will possess a book of the "wholesale" rather than of the "retail" type; he can wade into deep waters beyond the polished pebbles of the shore. The footnotes permit him to go to original sources.

Professor Swain attaches his discussions to the history of the development of mechanics. This is pleasing, and enriches and dignifies the subject. Indeed, the science of Strength of Materials is about a century old. Dean Turneaure a few days ago congratulated an assembly of students that they were studying in the year 1924 rather than in 1824 when there was so little material to study; just what the reaction of most students to this congratulation might be is doubtful.

Tredgold, in 1824, in his Practical Essay on the Strength of Cast Iron, reviews the literature of the time and discusses the principles of flexure. Poncelet, also in 1824, was charged by the French government with the establishment of a course in the science of machines; he examined minutely the construction and operation of existing machines in workshops and produced a series of lessons, afterward published in 1874, that have the atmosphere of a modern treatment of structural mechanics. Weisbach in 1846 clothed the bones of mechanics with flesh. Rankine's Applied Mechanics, 1858, was the gymnasium of early American students. Cotterill's Applied Mechanics, 1884, is a thoughtful and discriminating text; the chapter on stress and strain is notable for simplicity and depth. Recent books have been more teachable and provide for the inrush of students to technical colleges. Merriman of Lehigh and Church of Cornell developed a multitude of students; the rare quality of their teaching, differing so greatly in method, is shown in the disciples who have spread the methods of these masters to new institutions. Merriman's texts are marked by clearly worded and well organized discussions with a minimum of mathematical machinery and diagramming. Church's texts are notable for the reality with which he invests fundamental principles of mechanics and algebraic processes; he develops a power of analysis. One of the best British authors is Morley, 1908.

At present the teacher of structural engineering finds a new form of text, in the books ordinarily offered, evidently for office as well as class use, covering special fields, excellent in printing, well illustrated, but limited in scope, and sometimes of narrow and empirical treatment. The manifold rules of practice and display of standards confuse, when they do not narrow, rather than organize and enlarge the mind of the student. They develop detailers rather than designers, show the "how" rather than the "why," and inculcate a blind acceptance of unproven and unlimited statements. The wealth of illustrations and working diagrams brings the student mechanically to an end. Explanation of minute matters leads the student to the habit of demanding explanations of difficulties that he himself should surmount. Such texts fit the mentality of many students that throng our classrooms. Such texts likewise suit the purposes of a class of teachers who present beautifully arranged and carefully worked out problems of computation that are copied by the student and afterward appear in a "design." Habits of orderliness and neatness, so necessary in an office, are formed at the expense of initiative and power. The upper third of the students need but little of such exercise. Writers should be aware of the new determination of educators to train for power rather than for immediate performance. We need books that will be food for thought for the brighter students, those men who will create the advances of the future.

Professor Swain's treatise, in the opinion of the reviewer, fills this need. The quotation he selects from Francis Bacon is appropriate: "Read not to contradict and confute, nor to believe and take for granted, nor to find talk and discourse, but to weigh and consider."

Certain general aspects of Vol. I may be noted. There is abundant mathematical analysis of extreme complexity, but, as may be inferred from Chap. XXIV, the author is not playing a mathematical piano. However, we must not be misled, for we will find pages (for instance 338 and 339), bristling with intricate mathematical development; the treatise is not meant for babes.

The author is philosophical, that is, shows a thinking consideration of things. He is impatient at hazy conceptions, and gives a critical examination to traditional doctrines. These texts, having been, no doubt, hard to write are easy to read. There is simplicity and clearness of statement with an accurate terminology and without that over-abstraction that hypnotizes the mind of the reader.

Vol. I: Strength of Materials—Volume I has style. Style is no more expected in a technical book than in a government bulletin after it has passed the scrutiny of the official editor. Yet style gives a freshness and vitality, engages and holds the attention. The author is present like the teacher in the classroom.

Chap. II, a Short Summary of the Essential Principles of Mechanics, is evidently the result of past experiences in the classroom, in clearing up misconceptions common in the student's mind. Professor Swain (p. 16) believes analytical methods to be generally superior to graphical methods in ease as well as rapidity.

Chap. III presents a useful treatment of geometrical relations, including the moment of inertia and the ellipse of inertia.

Chap. IV, on Behavior of Materials Under Loads, Stress, and Strain, contains an excellent discussion of fundamental properties, such as elasticity, plasticity and relations obtained from testing materials. The relation between stresses at a point introduces the treatment of ellipse of elasticity. In the reviewer's experience the simple graphical approach to ellipse of elasticity is followed more easily by the student. The author tells us that "the stress-strain diagram for a static, gradually-applied load, is not the same as for a sudden application." But this is a statement that does not seem to be supported by evidence. In general the author shows a wide knowledge of the actual properties of materials as determined by tests.

Chap. VI, on Pure Tension and Compression, discusses fully the stresses acting in a tension piece with notches and holes. This is an excellent example of the author's critical examination of elaborate mathematical developments erected on a weak foundation. Concerning a formula for the stresses around the punched hole quoted from Föppl, the author states: "The situation, therefore, appears to be this: those equations require that there must be a hole, but they are not correct, if at all, unless there is no hole at all. And it is undeniably true that they are not correct in any practical case whatever. . . . They are an abuse of mathematics, and of common sense as well." The author proceeds with his usual critical acumen to a discussion of experiments to determine stresses by optical methods and closes with a practical consideration of eyebars.

Chap. VII and VIII discuss Shearing and Torsion, including the Torsion in Non-circular Sections. Chap. IX, on Distribution of Stresses on a Section, locates the neutral axis and the kernel.

The Theory of Stress in Beams occupies Chap. X, including moment-area methods of finding deflection. On p. 234 the distribution of stresses above the elastic limit is carefully discussed. On p. 244 there is a treatment of flexure for reinforced-concrete beams by the method of transformed sections. This method is really the most satisfactory approach of the student to reinforced-concrete beams. Chap. XI covers Shears and Moments on Beams. Chap. XII contains the equations for slope and deflection of beams in pure flexure with numerical examples. Chap. XIII treats the more complicated cases of combined stresses. Chap. XIV takes up beams over more than two supports. The method (p. 360), which determines the reactions of a beam over two supports by the equation of upward and downward deflections, proves to be illuminating to the student mind. On p. 362 is given a simple method of moment areas which leads to the derivation of the theorem of three moments. The author also introduces (p. 366) a useful conception of a beam over several supports, which is made up of several simple cases, involving hinges at the point of inflexion with a collection of cantilevers and simple beams.

The chapter on Reinforced-Concrete Beams is mainly a reproduction of the conventional equation found in the report of the Joint Committee, but the author promises to treat the subject of reinforced-concrete design in a later volume. It is to be hoped that he will give then a stern analysis of reinforced-concrete design.

Chap. XVII, on columns, discusses end conditions and various formulas that have been proposed. The author prefers Rankine's formula. The reader will find a good example of Professor Swain's method of treatment on pp. 425 to 428 in his discussion of the derivation and meaning of Euler's formula. The behavior of columns under test and the interpretation of several important researches are exhaustively discussed.

The usual treatment of hollow cylinders and spheres occurs in Chap. XVIII and a practical discussion of stresses in metals in Chap. XIX.

In Chap. XX, the Flexure of Curved Bars, the author postpones the complete theory of curved bars until the treatment of arches. He discusses the case of hooks. In an example on p. 484, by the usual method of planar distribution of stress, the maximum tension in a hook is found to be 28,648 lb., while by the method which assumes that plane sections remain plane the tension is 44,444 lb. In Professor Swain's opinion the first result is the more correct of the two.

Chapter XXI gives a description of machines and the technique of tests of materials. Chapter XXII is an excellent review of repeated or reversed stresses and fatigue of materials. On p. 533 Doctor Swain criticises severely the method of determining fatigue by the rotating beam machine. "For all of these reasons," he says, "and others which will be mentioned, the writer believes that the results of repeated tests on rotating bars must be regarded with doubt. . . ."

Chapter XXIII discusses the various causes and conditions of failure of a material, whether under a limit of stress or a limit of strain. The author prefers to base the factor of safety on the ultimate strength rather than on the elastic limit, p. 538. He discusses the question of strength under combined stresses, quoting the experiments of Bridgeman, Becker, Guest, and Hancock. He states that:

> If it could be once demonstrated that the ultimate tension in any direction does increase as the *tension* at right angles increases, the maximum strain theory would

be established as the one most nearly in accord with fact, at least for both principal stresses and tension. This would be a crucial test. . . . As tests appear to indicate the correctness of the maximum strain theory quite as much as they do the correctness of any other—or more—*it is clear that it is wise to adopt the maximum strain theory whether it is strictly true or not.* The maximum stress allowable in tension should therefore be less when there is a compression at right angles than when there is none, according to formulas that have been given; and more when there is tension at right angles.

The author's remarks (p. 553) upon the varying viewpoints of those dealing with the question of failure and those making designs are of interest.

Chapter XXIV, on Mathematics, Testing and Common Sense, is stimulating. The following quotations will serve to display the viewpoints of the author:

Just as there is no vice worse than excessive or misapplied virtue, so there is no engineering mistake worse than excessive or misapplied mathematics, though many people seem to think that there cannot be an excess of it. . . . The danger in the use of mathematics is that the machine itself is so interesting that attention will be concentrated upon that machine and its operation, and diverted from the data, which are more important. . . .

Many students are lost without their books. If they would perceive clearly the fundamental principles and the assumptions made, and remember these, they could, without books, work out fundamental formulas at once. . . .

The other indispensable tool is experiment, or testing. There is no other way to discover the properties of materials, or to penetrate into the laws of nature, than to get the facts by experiment and to verify conclusions by tests. Yet it is possible to go too far in this direction, as any other. . . .

We often resort to testing to avoid the necessity for thinking. In too many cases, if we do not understand a thing, instead of trying to reason it out, we test it. . . .

The writer must confess to a profound distrust of field extensometer measurements, except, perhaps, to gain some idea of the amount of impact. . . . But it is a fact that some published results of elaborate extensometer measurements can be shown to be wrong, because they do not conform to necessary relations. The writer knows of some measurements of this kind in which the same deformation was shown under quite different loads; hence the strain and stress do not depend directly upon the load, which is of course absurd.

The reviewer is of the opinion that Professor Swain is too sweeping in his criticism of field extensometer measurements. From these we have learned much about the action of reinforced-concrete structures. Naturally the technique had to be developed and corrections found for temperature deformation which at times exceeds those due to load.

Vol. II—Fundamental Properties of Materials—The second book is of a different order from Vol. I. In this the author becomes what a writer in the January *Atlantic Monthly* is pleased to call "a mere professorial person"—that is to say, he has admirably and clearly surveyed the fundamental properties of materials, cleared of a mass of purely technical detail. The discussion appears to the reviewer to embody the results of recent researches of a substantial character. There are abundant references to sources. The text does not deal in detail with the processes of manufacture. The needs of the constructing engineer have been mainly considered—what in the author's experience is most important for him to know. Vol. II will be a useful companion to a laboratory manual. It is a well proportioned part of a work on structural engineering.

The proportion of the topics may be judged by the pages devoted thereto. Wood, 34; Iron and Steel, 90; Non-ferrous metals and Alloys, 8; Stone 9; Clay Products 10; Calcareous Cements and Concrete, 32; Paints and Varnishes, 12. Perhaps the material on wood, while interesting, is out of proportion. Fig. 4, p. 20, is hardly a representative failure of a short block. The author notes the characteristic property of dry wood, whereby the elastic limit is higher under rapidly applied load. Grades and working stresses are briefly but adequately treated.

Nowhere else has the reviewer seen a more intelligible discussion of the constitution and treatment of iron and steel than in Chap. III. The explanation of the mechanism of strain in steel is particularly clear and convincing. The setting up of slip bands in the crystals and the greater strength of the amorphous material between the crystals is not usually understood by structural engineers.

A topic of live discussion, the relation of the strength of brick masonry to the properties of the individual brick, is discussed, with citation of the recent experiments of the Bureau of Standards, and a reference to tests at Columbia University. The author in this case also has kept in touch with current work.

In the present state of research in cement and concrete when there is so great a volume of results of experimentation, the writing of Chap. XII is an undertaking of some difficulty. The information is greatly compressed; established facts, in brief sentences, are supported by references in footnotes. Unsettled questions are indicated, as for instance, p. 164, the steam tests for soundness and chemical composition. Five pages are devoted to a discusion of theories of proportioning; the author concludes that in proportioning concrete voids, fineness modulus, surface-area, and proportion of water all come into consideration. The reviewer notes the absence of recommended values of slump to be used in controlling construction, and also the absence of data on expansion and contraction of cements and concretes, a matter that is assuming importance. Some discussion might well be given to the danger of fine dust in the aggregates, as well as the evils attending the pouring of wet concrete containing this fine material from whatever source.

The reviewer warmly welcomes these volumes because they meet his ideals and his needs in the teaching process. The volumes are a notable contribution to the literature of scientific engineering.

Maurer's Technical Mechanics Rewritten

TECHNICAL MECHANICS: Statics, Kinematics, Kinetics—By Edward R. Maurer, Professor, and Raymond J. Roark, Assistant Professor of Mechanics, University of Wisconsin. Fifth Edition, Rewritten. New York: John Wiley & Sons. London: Chapman & Hall. $3.50 net.

For the second time since its original appearance, this book has been rewritten, this time with Professor Roark in collaboration. The aim in the latest rewriting, as stated in the Preface, has been "improvements in the presentation; changes in subject matter; inclusion of a larger number of solved illustrative examples; addition of new problems; a better grading of all problems; and a return to the common practice of more minutely subdividing the matter into a relatively large number of articles." The prst edition was reviewed in *Engineering News*, Jan. 14, 1904, and the third edition (the first rewriting), Sept. 17, 1914.

Problems of the Steel Fabricator

REVIEWED BY JOHN C. MOSES
Engineer of Construction, The Boston Bridge Works, Boston, Mass.

DETAILING AND FABRICATING STRUCTURAL STEEL—By F. W. Dencer, C. E., Engineer, Gary Plant, American Bridge Co.; M. Am. Soc. C. E., M. Western Soc. Engineers. New York and London: McGraw-Hill Book Co., Inc. Cloth; 6 x 9 in.; pp. 511; 328 halftones and line cuts; classification of structures, glossary of terms. $5.

The fabrication of structural steel has grown from small beginnings, fifty years ago, to one of the great industries of the country. It differs from most of these industries in one important respect, the diversity of product being extreme. Practically no two jobs are alike and new problems are constantly being presented for solution. The machinery used must be adaptable to a variety of work, precluding the use of the specialized machinery that goes with mass production. The designer must therefore plan his work for the machines that are available. The men who organized the first bridge shops were the designers as well as the manufacturers, but most structural work is now designed by engineers who are not in such daily contact with the manufacturing end of the business as were their predecessors. They must secure the necessary information in other ways, and the book under review is an effort, on the part of a manufacturer, to impart this knowledge. Moreover, being a record of the practice of one of our largest and most recent organizations, it is of interest to all others engaged in fabricating structural steel, and especially to the many engineers that are still employed by the manufacturers. While these engineers are no longer mainly occupied with questions of strength and general design, they are now faced with the problem of efficiently fabricating this widely varied product, and can profit by an exchange of experiences.

The author first outlines the different departments of a typical organization, with their respective duties and officials; the Gary plant of the American Bridge Co. serving as an illustration. Next there is a statement of the fundamentals to be followed in planning a shop building and organizing its personnel. Forms of contract and methods of preparing estimates are discussed, an elaborate system of classifying all known types of structures being given in an appendix of some forty pages that comprise over a thousand items. Then come chapters describing in detail the organization and work of the engineering department. The duties of the engineer in charge and his assistants, of the squad foremen, checkers, draftsmen, office clerks and blueprinters, are fully stated, and the ways in which they can increase their usefulness in their respective positions are pointed out. Rules for keeping account of extra work and for making shop changes are given. A method of grading draftsmen for proper adjustment of wages makes an interesting section of this part of the book.

Following these chapters is a "set of instructions to draftsmen" to secure "consistency, uniformity of standards, and the use of accepted details and practices." These deal in turn with bridge work, office buildings, mill buildings, bridge machinery, ships and tank work, and are illustrated with detail drawings. These chapters teem with valuable hints for the designer and draftsman, pointing out the most economical details for the shop, and showing many things that should be avoided. They also devote considerable space to rules for ordering material, and for numbering and shop marking drawings. Various tables of rivet gages, standard connections, rivet clearances, etc., are included, although the author has intentionally omitted the tables of properties of sections and most of the other data given by the mill handbooks. Unfortunately, the valuable information given in these chapters tends to be obscured by comparatively unimportant details, many of which could be omitted, and others treated in a broader way.

The latter half of the book will prove the most interesting to many readers. It describes the work of the shop after the drawings are made and the material ordered. Each operation is taken up in detail, the machines used are pictured, and their limitations noted. Chapters on punching, shearing, riveting, and finishing are followed by others on the hoisting apparatus used during fabrication, on shop inspection, painting, the forge and machine shops, and on shipping the completed work. Every designer should have this knowledge as well as every shop draftsman, and the account given here will greatly assist those who lack actual shop experience. The reader is frequently given the benefit of the author's own experience in practical suggestions, one of which the reviewer would especially commend to the writers of our specifications: i.e., the author's statement that, "as far as known, no good reasons have been advanced which justify the use of fitting paint." His reasons for *not* using paint on contact surfaces seem convincing and a challenge to the designer that calls for a decision.

The book closes with a chapter on economical fabrication and one on drawing and shop errors. These are notes from the author's own experience, summing up, in an effective way, the book as a whole. The field covered is in many respects a new one, and the point of view one not often available, for few men engaged in meeting the problems of the fabricator have the time or the inclination to write out their experiences for the benefit of others. The author is to be commended for his contribution to the literature of this industry.

Graphic Statistics in Management

GRAPHIC STATISTICS IN MANAGEMENT—By William Henry Smith. New York and London: McGraw-Hill Book Co., Inc. Cloth; 6 x 9 in.; pp. 360; 242 graphical charts. $4.

The use of statistics in business management is not new. Neither is it a novelty to apply to the presentation of business facts the graphical methods with which engineers are so familiar. Yet there is a timely flavor to Mr. Smith's book, because during recent years business men have shown a growing appreciation of the need for more precise data in planning their operations, together with a more general acceptance of the graphical method.

The book offers a very complete survey of modern practice in statistical analysis and graphical presentation. The word "practice" is used advisedly and in a double sense, as the book is essentially practical. No space is devoted to the theory of statistics, the author having sought rather to shed light as to the kind of statistical data the business executive needs to carry on his everyday work, where he can find the facts, how he can interpret them and how he can present and record them most helpfully.

Aside from its application to statistics, strictly speaking, Mr. Smith has indicated also how the graphical method may be applied to the visualizing of schemes for organization and administration. All this is well done.

Strange as it may seem to engineers, many business men do not take kindly to graphical methods. They do not seem to be "eye-minded" in such matters. More than once the reviewer has been astonished to have some executive ask him to set forth in figures some perfectly good chart that appeared on its face to present a vivid picture of the situation under discussion. But with the trend of the times more and more business men probably will be brought up on charts and graphs, and within appropriate limits these devices will find their place in the kit of business tools. The present work, widely circulated amongst business executives, should help them to understand the subject clearly and to indicate the extent to which they may find the graphical method valuable.

PUBLICATIONS RECEIVED

MORE THAN FIFTEEN HUNDRED PAGES of Commercial Statistics for the Calendar Year 1923, compiled by the Statistical Division of the Board of Engineers for Rivers and Harbors, have been published as an "Extract" from the Report of the Chief of Engineers, 1924 (Washington, D. C.).

THE VEST POCKET Manual for Engineers, published annually by the University of Tennessee (Knoxville; 75c.) has now reached its 26th edition, with a total issue of more than 100,000 copies. These useful "Tables and Other Data for Engineers and Business Men" are compiled by Charles E. Ferris, dean of engineering and professor of mechanical engineering at the institution named.

A MODEL FORM OF HIGHWAY TRAFFIC ORDINANCE for adoption by cities and, it is hoped, for ultimate state enactment, together with a Code of General Highway Traffic Regulations and other related matters, has been published by the Eno Foundation for Highway Traffic Regulation (Saugatuck, Conn.). The pamphlet was prepared by William P. Eno, chairman of the board of the organization named, for presentation to the recent National Conference on Street and Highway Traffic at Washington.

PERMEABILITY TESTS ON BROKEN STONE CONCRETE, made at the University of Wisconsin (Madison) Engineering Experiment Station by Morton O. Withey, professor, and Christopher A. Wiepking, instructor in mechanics, are now available as a 55-p. illustrated bulletin (15c.). The work described was done in 1914 and 1915 and was similar in method to the tests on the permeability of gravel concrete made at the same place in 1912 to 1914.

ATTEMPTS TO COMPARE THE UNCOMPARABLE are so numerous as to make welcome the Comparative Tax Rates in the larger cities of the United States and Canada which have become a yearly feature of the *National Municipal Review*. The December issue of that journal contains 1924 tax figures, actual and readjusted on a comparable basis, for 184 cities of 30,000 population and more, compiled by C. E. Rightor, of the Detroit Bureau of Governmental Research. How uncomparable city tax rates as ordinarily reported are is shown by the large differences between the crude and corrected figures shown in Mr. Rightor's tabulation. Two adjustments were made (where necessary): (1) A correction for variations in the legal basis of assessment which although generally 100 per cent ranges downward to 25 per cent and (2) a correction for the estimated ratio of assessed to true value. (For terms on reprints of this and earlier studies, address National Municipal League, 269 Broadway, New York City).

A MOST INTERESTING CONTRIBUTION to a pertinent general problem is made by the American Academy of Political and Social Science in its publication, *The Annals*, for November, 1924. (Philadelphia; $2 in paper or $2.50 in cloth.) This issue, a 380-p. book, is entitled The Automobile, Its Province and Its Problems, and is devoted entirely to a number of articles by experts on the service, function and effect of the automobile on modern life. It is divided into nine sections, entitled The Services of the Automobile, The Manufacture and Sale of Automobiles, The Automobile in the Home, the School, and the Church, The Place of the Motor in our Transportation System, The Building and Financing of Motor Highways, Safety on the Highways Through Traffic Regulation, City Plans for Motor Traffic, International Problems Growing Out of the Development of the Automobile Industry, and The Services of Automobile Associations and the Universities.

THE FOURTH INTERIM REPORT of the Committee of the Institution of Civil Engineers of Great Britain on Deterioration of Structures in Sea Water carries on the very extensive investigations that were started by this special committee in 1916. There is nothing revolutionary in the discoveries which are reported here, but added to what has gone before there is being built up an enormous reservoir of information on the behavior of all kinds of structures—steel, wood and concrete—in sea water. No conclusions of any importance have been developed. (3½ s. in London, postage extra, from H. M. Stationery Office, Kingsway, W. C. 2; William Dawson & Sons, 87 Queen St., Toronto; British Library of Information, 44 Whitehall St., New York City.)

ADDITIONS to the specifications published by the Canadian Engineering Standards Association (Ottawa, Ont.; 25c. each) include Reinforced-Concrete Poles; Eastern Cedar Posts; and Railway Wire-Fencing and Gates.

WATERLOGGING OF THE SOIL in the Vicinity of the Punjab Irrigation Canals and Measures for the Prevention of Waterlogging has been issued as a supplement to Punjab Irrigation Branch Paper No. 20, on the same subject, published in 1922 and now out of print. The present report describes recent conditions and remedial measures, the latter consisting of drainage channels and the restriction of irrigation. (5s. 8d., in India, from chief engineer, Punjab Irrigation Works, Lahore, India).

HOUSING IN PHILADELPHIA, a 50-p. illustrated pamphlet, reveals a lack of accommodations for industrial wage earners and also widespread insanitary conditions in and about such housing quarters as exist. The report, made by Bernard J. Newman, managing director and secretary of the Philadelphia Housing Association (311 South Juniper St.), includes a brief section on water waste due to defective fixtures which indicates need of attention by the city authorities.

New Books and Revised Editions

[Those desiring copies of the books listed below or mentioned elsewhere in this section should order them from the publishers or from their local booksellers.]

EISENBETONBORGENBRÜCKEN FÜR GROSSE SPANNWEITER—von H. Spangenberg, o. Professor an der Techn. Hochschule München. Berlin: Julius Springer. Paper; 9x12 in.; pp. 17; line cuts and halftones. 1.5 goldmarks (36c.) in Berlin.

Reprint, enlarged, of an address on long-span reinforced-concrete bridges. Special attention given to structural reinforcement, which the author considers to have special utility in its proper application to large bridges.

ENGINEERING FAILURES AND THEIR LESSONS—By Edward Godfrey, Author of "Godfrey's Tables," "Steel Designing." Cloth, 6x9 in.; pp. 279; line cuts. $3.

HEAT TRANSMISSION OF INSULATING MATERIALS—Report of the Insulation Committee of the American Society of Refrigerating Engineers, 1922; Revised to 1924. New York: The American Society of Refrigerating Engineers. Paper; 9x11 in.; pp. 114; halftones, line cuts; tables. $2.

PROBLEMS IN BUSINESS ECONOMICS—By Homer B. Vanderblue, Ph.D., Professor of Business Economics, Graduate School of Business Administration, Harvard University, Economist, Harvard University Committee on Economic Research. Chicago and New York: A. W. Shaw Co. London: A. W. Shaw & Co., Ltd. Cloth; 6x9 in.; pp. 631; 42 forms or charts, statistical tables. $5.

PUBLIC RELATIONS: A Handbook of Publicity—By John C. Long, Manager of Educational Department, National Chamber of Commerce; previously on editorial staff, Class Journal Co. New York and London: McGraw-Hill Book Co., Inc. Cloth; 6x9 in.; pp. 248; illustrated. $3.

Describes publicity media and methods, taking up newspapers, press syndicates, magazines, the lecture platform, motion pictures and radio as media, and publicity methods for corporations, trade associations, chambers of commerce, individuals, etc.

DAS WESEN DES GUSSBETONS: Eine Studie mit Hilfe von Laboratoriumsversuchen—von Dr. Ing. G. Bethke. Berlin: Julius Springer, 1924. Paper; 6x9 in.; pp. 58; line cuts and halftones. 3.5 goldmarks (84c.) in Berlin.

Letters to the Editor

This department aims to be a forum for the discussion of the views of engineers and contractors. The range of interest should be as wide as possible. Contributors are, therefore, asked to make their letters short.

Tributes to George C. Whipple from Sir Alexander Houston and Desmond FitzGerald

Sir—It is with deep regret that I hear the sad news of the death of my old friend, Prof. George Chandler Whipple. I had the utmost admiration for him on personal grounds and his scientific work was known throughout the world. He used to come and see me at intervals—too wide apart for our mutual liking for each other—and it is not saying too much that I regarded him as one of my dearest friends. His loss will be widely and keenly felt—by no one more sincerely than the writer of this brief word of appreciation.

A. C. HOUSTON,
Director of Water Examinations,
Metropolitan Water Board.

London, England,
Dec. 15, 1924.

Sir—The obituary notice of George C. Whipple which appeared in *Engineering News-Record* (Dec. 4, p. 925) was not only a just appreciation of his professional career and the wider range of his activities and wonderful accomplishment but it gave also an excellent idea of the man himself.

It was my good fortune to be one of the early engineers in Boston to be charged with the care of the water supply of the city, the building of additional reservoirs and the improvement of the quality of the water delivered to the consumers. This work involved the employment of many assistants. Among them was Mr. Whipple. I had already erected at Chestnut Hill reservoir a small building, fitted with apparatus of various kinds for microscopic examinations for experiments on filtration.

I soon realized that Mr. Whipple was gifted to a remarkable degree with a genius for microscopic work and for devising improved apparatus. It was at that time that he perfected his remarkable method of taking the temperature of water in reservoirs at different depths by means of the thermophone.

Whipple's name and fame will endure during the coming generation, as far as we can now see, as one of the most brilliant among the long list of those who have labored for the improvement of the sanitary conditions of the race.

DESMOND FITZGERALD.
Cambridge, Mass.,
Dec. 23, 1924.

[An appreciation of Whipple from John M. Goodell appeared in *Engineering News-Record*, Dec. 11, p. 968.—EDITOR.]

A Contractor on the American Falls Dam Bid

Sir—The editorial in your issue of Nov. 27, 1924, p. 855, with reference to the bids on the American Falls Dam is somewhat unfair to the situation. You apparently believe the contractors voiced their desire to submit bids to an excessive degree and that there was a lack of competition. As I am somewhat familiar with this project and the circumstances attending upon this letting, I feel obligated to present to you related viewpoints with which you may not be familiar.

Prior to, and since the opening of bids, we have been advised by several responsible contracting firms, who desired to bid upon the work, that their reasons for not submitting bids on this work were as follows:

First: That after looking at the work they felt that the available funds would be insufficient and that it would be impossible to award a contract on account of this fact.

Second: They also felt that the engineer's estimate of cost would be so much lower than any bid that could be submitted by responsible contracting firms, that contract bids would not be considered.

Third: Many contractors after looking at the work believed that the river control problem on the Snake River at this point would be very difficult and hazardous.

Fourth: Many contractors also believed that bids were being called for on this project merely because of an insistent public demand but that in the final analysis the Reclamation Bureau would probably do the work themselves and that all bids would be rejected.

The contract was rather large in total amount, which eliminated a number of bidders on the project and the four reasons outlined above served to discourage many of those who would otherwise have bid upon a contract of this size.

As one of the bidders on this project I know that our firm, Atkinson & Atkinson, hesitated to submit a bid because of these reasons, although we were very desirous of securing this work, and we submitted our bid in good falth, sincerely believing that it was the intention of the department to award this contract to contractors if responsible low bids were received.

As a matter of fact, we bid closer than we usually do on work of this character, because we felt that we not only would have competition with other contractors, but we felt that we would have to compete with a very low engineer's estimate cost made the Reclamation Bureau on this project.

I am sure that you will also agree that the number of bids is not always a true index as to the real competition involved, as it is quite possible to obtain as low bids from two bidders as from twenty, and I think the engineering and contracting fraternity generally feel that extremely low bids were submitted on this project even though there were only two bidders.

Although we believed, and still believe, that the call for bids was made in good faith we can understand the reluctance which the average contractor would feel toward bidding on Reclamation Bureau work in view of the fact that for many years they have called for contractors' bids and arbitrarily rejected them summarily and continued their established custom of performing construction by the day-labor method, and it is quite likely that the Reclamation Bureau will have to overcome this prejudice on the part of the contractors before being assured of receiving a maximum number of bids on any one project.

Every effort was made by the contractors' associations, and individuals interested, to urge contractors to bid on this project and the honest efforts of those interested should not be discredited, and there is no doubt but that contractors will eagerly compete for Reclamation Bureau work if it becomes generally known that the Reclamation Bureau is awarding contracts and not merely taking bids.

I am sure that you realize the expense and expenditure of time involved in completing estimates on isolated work of this character, and contractors generally cannot be blamed if they do not submit proposals without some assurance of a contract being awarded.

Personal contacts with Secretary Work assure me that he is sincere in endeavoring to re-establish the use of the contract method in public works construction under his supervision, and I am confident that insistence upon this practice in the Department of the Interior and its allied branches will ultimately serve to bring forth keen competition on the part of contractors, once it becomes generally known that this is the policy of the department.

LYNN S. ATKINSON, JR.
Los Angeles, Calif.,
Dec. 7, 1924.

Gravel Road Corrugations

Sir—Various letters to the editor and your editorial of Oct. 16, 1924, have dealt with one of the most troublesome phases of gravel road maintenance. Extended observations by the writer in arid regions have led to the following conclusions:

1. At their worst before the actual breaking up of a consolidated gravel surface, the traffic corrugations may be 1 in. in depth, and spaced 20 to 40 in. trough to trough, or crest to crest. Viewed at night, with lights and shadows bringing them into bold relief, they resemble cultivator furrows at right angles to the highway.

2. These corrugations may in some cases have their inception from longitudinal rolling; but light cars at high speed are known to develop them, and are occasionally responsible for their beginning.

3. On desert highways after a six months' drought it can hardly be claimed that either the subgrade or the binding material is in a plastic condition. As this is the time when the corrugations become most pronounced, they more likely result from disintegration due to repeated impact, rather than from deflection or sliding. It also happens that the same weather conditions preclude effective blading or dragging of well consolidated roadways; therefore the wavy highway surface is often construed as the index of neglect in this regard.

4. Where miles of gravel road show corrugations for most of the distance, the sections free from these defects are found either to have a more tenacious binder, such as ferruginous clays or calcareous elements bearing the same metallic oxides, or else there is a cushion of unconsolidated sand and fine gravel to absorb the shock of traffic and to fill depressions as they develop. Thus are furnished the most definite clues leading to prevention or correction of wavy surfaces.

5. Whatever the harmonic law that governs in the rhythmic sway of vehicles, the cars of short wheelbase when driven at high speed both accomplish and sustain the greater part of the damage resulting in or from traffic corrugations of gravel roads. C. S. JARVIS.

Ann Arbor, Mich., Dec. 17, 1924.

Competitive Bidding by Engineers

Sir—I read with more than passing interest the article which appeared in your issue of Dec. 18, 1924, p. 991, entitled "Port Authority Asks Engineers to Bid on Bridge Design."

Undoubtedly the Port Authority, through its chief engineer, had a perfectly legal right to handle this operation just as it appears to have been handled. I take no issue with conclusions reached. That is entirely beside the point. It does seem to me, however, that a somewhat different and more ethical method might have been employed for accomplishing the same results than the one reported.

In this connection I wish to express my most hearty appreciation and endorsement of your editorial on this subject, which appeared in the same issue. It so clearly sets forth the principles of proper conduct in large engineering operations that I trust my words of commendation may only be a few of the many you should receive from all branches of the profession. W. S. KINNEAR.

New York City, Dec. 26, 1924.

The Tennessee River and the Anti-Power Complex

Sir—In your issue of Dec. 18, 1924, p. 980, is published an excellent editorial on "The Anti-Power Complex" of which the central feature is the situation at Muscle Shoals. This editorial merits most thoughtful consideration by all interested in hydro-electric development in general and in particular by those interested in such development at Muscle Shoals or elsewhere on the Tennessee River. For this reason it is unfortunate that toward the close of the fourth paragraph you have used the phrase "one small river valley," in referring to the Tennessee. There has already been too much unreasoning partisanship in connection with affairs on this river and this phrase will, in the minds of some, classify your impartial editorial as a biased attack on the good name of this stream.

What is small and what is great depends primarily on the point of view, which, in the case of a river, may be that of length, breadth, depth, volume of discharge, power, navigation, history, etc. While the Tennessee can be well defended from any of these viewpoints, it is not necessary to make such an attempt here. As evidence of its commonly accepted place in the popular mind refer to p. 718, World Almanac for 1923. There, under the heading "Great Rivers" (of the United States), are listed something over 100 streams with their length, and in this list the Tennessee ranks 8 or 9. Unfortunately when analyzed a bit this table opens the doors to much dispute for those so inclined. For example, the length of the Tennessee is given as 1,200 miles. As a matter of fact this distance is the total length of navigable river included in the Tennessee proper, together with its tributaries. The Tennessee itself is 650 miles long, all of which is in fact navigated, and though this may fail to prove to some that it is great, clearly it protects it from being called small. Incidentally, its basin has an area of 40,800 sq. miles, something larger than the state of Ohio, which, if not large, surely is not small.

The editorial deals with power only, therefore, consider the Tennessee from the standpoint of power and no other. For something over four years I have been making a study of the power-navigation resources of the Tennessee River and its tributaries. This work is still in progress. On March 31, 1924, in testifying on this subject before the Committee on Rivers and Harbors of the House of Representatives, I said ". . . therefore, we have a right to guess that there are between three and four million horsepower in the Tennessee basin, everything included." (See p. 20 of printed record of this hearing.) This estimate is still a guess, but it is founded on a good deal of reliable information and as yet I see no need to qualify it.

I do not believe that the editor of *Engineering News-Record* considers that, from the power standpoint, a river system capable of producing three or four million horsepower is a small one, the phrase quoted could not have been intended to have so important a meaning.

HAROLD C. FISKE,
Major, Corps of Engineers,
District Engineer.

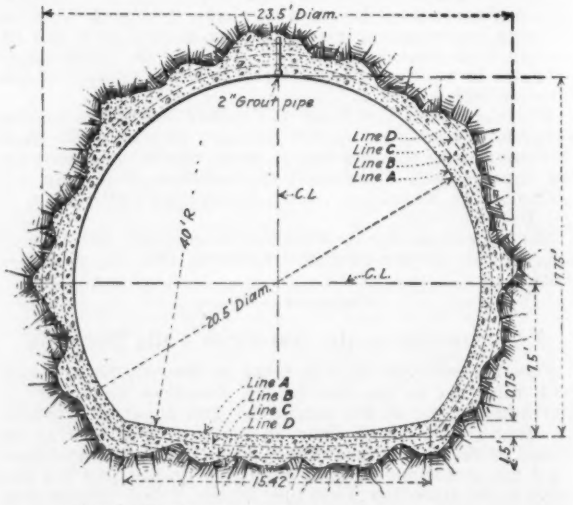
Chattanooga, Tenn.,
Dec. 26, 1924.

[There was no disposition on the part of the editor to minimize either the power possibilities or the value of existing installations on the Tennessee. Diminutive adjectives were used merely to denote the value of the installation under discussion compared to the total power in use in the United States.—EDITOR.]

Exact Section of Skagit Tunnel

Sir—In *Engineering News-Record*, Oct. 30, p. 700, appears a section of the Skagit tunnel in which the lining is stated to have "a minimum thickness of 12 in."

Herewith I send you a drawing of the lining as specified in the contract and to which the contractor adhered as nearly as possible. You will notice that in this cross-section the lines A, B, C and D are 6 in. apart and that no projection over 3 sq. ft. in area was allowed on the inner



Line A — Finish line of concrete
Line B — No projection allowed beyond this line
Line C — No projection over 3 sq. ft. area allowed on this line
Line D — Assumed line of excavation. Excavation, 14.86 cu. yds. per linear ft.; lining, 3.73 cu. yds. concrete per linear ft.

DETAILS OF LINING SPECIFICATIONS, SKAGIT TUNNEL

side of the second line which is 12 in. from the inner surface. Anything less than an area of 3 sq. ft. was permitted to remain.

I call this to your attention as it should not be generally understood that the lining was 12 in. minimum thickness when such was not the case. C. F. UHDEN,
Chief Engineer, Skagit River Development.

Seattle, Wash.,
Dec. 4, 1924.

News of the Week

CURRENT EVENTS IN THE CIVIL ENGINEERING AND CONTRACTING FIELDS

News Brevities

Annexation of Santa Monica, Calif., to Los Angeles was defeated by a majority of 1,067 in a total of 8,766 votes cast in Santa Monica on Dec. 16. There were 12,443 registered voters.

Colorado Will Spend for Road Work in 1925 about $6,500,000 present plans contemplate. The budget calls for $4,550,000 and there is on hand $2,124,000 left over from uncompleted work of 1924 and an assurance of the $4,550,000 from various taxes and federal aid.

Electors of Watertown, S. D., on Dec. 31, 1924, voted 686 to 437 against adopting the city manager plan of government. The defeat was attributed to a snowstorm and to lack of an active campaign for the plan, although it had been endorsed by the mayor and board of aldermen.

Voters of the South Park District of Chicago will vote at the election to be held Feb. 24 on a proposed $4,000,000 bond issue for the construction of an outer boulevard link connecting with Lincoln Park. The proposal has been approved by the South Park commissioners and the bond issue covers half the expense involved. The second half will be financed by the Lincoln Park Board.

After Attending a Conference of sanitary administrators of Far Eastern countries at Singapore, Dr. Norman White, director of the Bureau of Epidemics of the League of Nations, Geneva, Switzerland, will organize an epidemiological bureau at Singapore from which radio news of the prevalence of communicable diseases in the Far East will be transmitted to Geneva.

Plans for an Aerial Survey of the Cumberland River between Granville, Tenn., and Burnside, Ky., are being made by the U. S. Army Engineers. Bids are being asked of commercial flying concerns and it is expected that the work will be undertaken in the near future. The survey will include about 200 miles of the river valley and is to be made the basis of the U. S. Engineers' study for the best method of developing the power possibilities of the Cumberland River.

Tentative Arrangements Have Been Made whereby the Los Angeles County Board of Supervisors will supply $15,000 toward the arch dam tests to be made in connection with investigations being carried out by Engineering Foundation. The board has yet to pass formal resolution appropriating the money but no trouble is anticipated in securing this amount. Negotiations were carried on in Los Angeles by Louis C. Hill, of Quinton, Code & Hill, and H. Hawgood.

Engineering Fifty Years Ago

From *Engineering News*, January, 1875

THE technical schools of the country have been well patronized during the past year, and the most prominent of them, the Stevens Institute of Technology, at Hoboken, N. J., under the tuition of such able teachers as Prof. R. H. Thurston and De Volson Wood, has become so overcrowded that it is expectet that the class entering next year will be restricted in number by a competitive examination, and that the charges for tuition will be made nearly equal to those of other technological schools. It is to be hoped that the young men graduating from these institutions will do honor to their chosen profession, and in time purge it of much of the odium of incompetency that now rests upon it.

Chico Project and Land Appraisal Under Study

Proposed reclamation of an area of land east of Chico, Calif., involving about 35,000 acres of land on the east bank of the Sacramento River, to be supplied with water from Deer Creek and Butte Creek, will be investigated by the Bureau of Reclamation under an arrangement for financial co-operation just made with the Chamber of Commerce of Chico. The latter will contribute $5,000 and the Reclamation Bureau will appropriate an equal sum for the expense of the engineering and soil surveys; both contributions may be increased if necessary. This is the first occasion of a local chamber of commerce giving financial support to reclamation study.

Reappraisal of lands on the existing reclamation projects, under the reclamation provisions of the Deficiency Act passed last month, is to be undertaken by two committees of the Department of the Interior, headed respectively by Ex-Governor Thomas E. Campbell of Arizona and Dr. John A. Widtsoe, of Utah. Arrangements are being made to carry out the reappraisal of 21 of the present 25 projects. Lands on each project are to be classified as to productive power, with a view to arranging such readjustment of repayment conditions on lands of low productivity as will enable the settlers to farm them with better chance of success. It is expected that the committees will include state representatives, to be appointed by the governors of the states in which the projects are located. The appraisal work will occupy most of the coming year.

Road Builders Associatiou Holds Successful Convention

A good attendance and excellent papers made the technical meeting of the American Road Builders Association in Chicago last week one of the most successful ever held. There were from 150 to 300 persons in attendance and few of the 18 speakers at the six sessions were denied an encouraging audience. A noticeable feature, too, was that once assembled the audiences remained virtually undiminished through the entire program of the sessions. This was perhaps due to the fact that the papers generally were not highly technical and, therefore, adapted to hold the interest of a mixed audience of contractors and engineers with a sprinkling of manufacturers, materials producers and general road and street officials.

Abstracts of a number of the papers are grouped together in another part of this issue and others will follow in succeeding issues. As usual the business sessions were brief. An election of a nominating committee, the adoption of a few brief resolutions and the election of officers for 1925 completed the business conducted in convention. Among the resolutions was one suitably commemorating the death of Will P. Blair whose long labor in promoting improved roads is familiar to highway engineers. It was resolved also that the "Permanent International Association of Road Congresses deserves the support of the members of this association and that the United States should become officially a member of the international association."

Count of the letter ballot showed the election for president of W. H. Connell, engineer executive, Pennsylvania State Highway Department.

State Engineer Finch Names Staff

Roy G. Finch, who was elected state engineer of New York last November and who assumed office Jan. 1, 1925, is a graduate of Rensselaer Polytechnic Institute. He joined the engineering staff of the state engineer in 1908, rising through various grades until in 1919 he was made deputy state engineer. He retired to private practice in 1922, maintaining an office in Albany, N. Y.

Mr. Finch has chosen the following as his chief engineering staff: Frank R. Lanagan, a graduate of Rensselaer Polytechnic Institute, 1905, and former city engineer of Albany, N. Y., deputy state engineer; Charles R. Waters, assistant deputy; E. D. Hendricks, William W. Cronin, and J. S. Summers, division engineers. Theodore Horton is chief sanitary engineer, A. R. McKim inspector of docks and dams, and R. E. Phillips engineer of claims.

Drainage Congress Meeting Is Mainly Technical

Ditch and Tile Work—Drainage vs. Hunting—Legislation and Land Settlement—Flood Control

Land colonization, drainage legislation and flood control as well as drainage practice were included in the program of the 13th annual meeting of the National Drainage Congress, which was held at Chicago on Jan. 5 to 7 with an unusually small attendance owing to simultaneous meetings of the good roads convention and the levee and drainage contractors association. Engineers represented a majority of the attendance and there was a conspicuous absence of the political and spread-eagle addresses which have been features of some of the earlier meetings. For the third day, the entire time was given up to a "fertile land conference," with papers on land settlement and colonization, and the selling and appraisal of reclaimed lands.

DRAINAGE WORK REVIEWED

In regard to tile drainage, J. W. Dappert, Taylorville, Ill., reviewed the great decrease in work of this kind in recent years, owing partly to the great increase and cost of tile and the decreased purchasing power of farm products. There is much work of this kind to be done and he considered it advisable for landowners and farmers to proceed now with proposed improvements, since prices have declined to a point below which further reduction appears improbable. Tests of the strength of tile, reviewed by W. D. Gerber, Chicago, show that the bearing capacity of a drain depends upon three factors: the strength of the pipe, the method of bedding or foundation and the method of covering or backfilling. Tests of the flow capacity of different kinds of pipe were reviewed by D. L. Yarnell, U. S. Department of Agriculture.

Improvements required on many old drainage districts, due both to changed conditions and to neglect of the original works, were described by C. H. Young, Muscatine, Iowa. These include the clearing and enlargement of ditches, the provision of adequate pumping plants and the construction of additional tile drains. The advantages of flat slopes, about 1 on 3, for ditches in soft or loose soil, were presented by Jacob A. Harman, Memphis, Tenn., in discussing the design and maintenance of drainage ditches. For the control of silt, to prevent the clogging and filling of ditches, Roy N. Towl, Omaha, Neb., advocated a system of diverting the flow over areas of low land, allowing the silt to be deposited while the clear water returns to the ditch.

Land appraisals at different stages of development are necessary for the success of a reclamation project, according to a paper by L. K. Sherman, Chicago. There must be an appraisal of land value before reclamation, an estimate of value to result from reclamation and finally an actual appraisal after reclamation. The best appraisers are local farmers in co-operation with an engineer and a business man experienced in making valuations for investments. Conservation of water resources on a comprehensive basis for the purpose of utilizing the water and preventing flood damage was advocated by Clark E. Jacoby, Kansas City, Mo., who particularly favored headwater reservoirs for the control of flow in the interests of navigation and power development along the streams. He considered that there should be no controversy between drainage interests which seek to reclaim land and the sporting interests which seek to maintain land and water areas for fishing and hunting, since there is a field for both these interests.

The president elected for 1925 is E. V. Willard, state commissioner of drainage and waters, St. Paul, Minn. The four vice-presidents are Roy N. Towl, Omaha; H. J. Sternberg, St. Louis; L. S. Keeley, Mayville, Wis.; and George Dingman, Detroit; secretary, C. R. Thomas, Chicago. The date and place of the next meeting will be determined by the board of directors.

Mississippi Valley State Highway Officials Elect Officers

At a very successful meeting in Chicago during the road show last week the members of the Mississippi Valley Conference of State Highway Departments elected as president H. B. Piepmeier, state highway engineer of Missouri, and as secretary L. A. Boulay, state highway commissioner of Ohio.

70,000-Hp. Hydro-Electric Plant on Green River to Be Built

The Blue Ridge Power Co. has announced that it will begin construction of a hydro-electric power plant on the Green River near Saluda, N. C., in the near future. The project calls for a dam across the Green River, a tunnel 13,000 ft. long, and a power house with two 35,000-hp. hydro-electric units. The estimated cost is between $3,500,000 and $4,000,000.

Construction will be carried on by the forces of the Blue Ridge Power Co.

Moffat Tunnel to Serve Rio Grande R.R.

To provide a direct short line between Denver and Salt Lake City as soon as the Moffat Tunnel on the Denver & Salt Lake R.R. is completed, the officials of this road have organized the Denver & Salt Lake Western R.R. to build a line about 40 miles long from their road at Orestod southwest down the Colorado River to Dotsero, on the Denver & Rio Grande Western R.R. From Denver, the present distance by the latter road is 345 miles to Dotsero and 745 miles to Salt Lake City, while the new tunnel route will reduce the distance to Dotsero and Salt Lake City by about 150 miles.

Eventually the Denver & Salt Lake R.R. will be extended from its present terminus at Craig, Colo., to Salt Lake City, giving a short line of about 565 miles from Denver. But as this 300-mile extension is not likely to be built for several years there is evident advantage in the earlier combination route of 590 miles as compared with the present 745 miles.

Weeks Approves Idea of Golden Gate Bridge

Secretary of War Outlines Means of Overcoming Objections To Transbay Structure

A letter has been received in San Francisco signed by John W. Weeks, Secretary of War, and announcing the decision of the War Department on the application for permission to bridge the Golden Gate. The letter says: "I am pleased to inform you that the project as a whole meets with my approval." The hearing before the army engineers on this project was recorded in *Engineering News-Record*, May 29, 1924, p. 951. Secretary Weeks' letter outlined the requirements with which the city would be expected to comply, as follows:

"The objections to the bridge from the military point of view can be eliminated if the city of San Francisco and the counties interested in its construction will bear all expenses connected with the moving, rebuilding and replacing of elements of the defensive and other military installation damaged by such construction; will bear the expense of construction and maintenance of approaches to the bridge; will give the United States complete control over the bridge in time of war; will permit government traffic at all times free of charge; will make provision for wire and pipe lines on the bridge for war department use free of charge; and will subject the construction of the bridge and its approaches, so far as such construction relates to the military defenses of the harbor and the military reservations affected, to the direction of the Secretary of War or his authorized representative, the district engineer, first San Francisco district."

The only further stipulations are that before actual construction is commenced that San Francisco shall get (1) approval by the Chief of Engineers and the Secretary of War on detailed plans of the bridge; (2) permits from the Secretary of War for rights-of-way across the military reservations on the north and south sides of the crossing; and (3) a permit for the temporary occupancy of such areas on the two military posts as are needed for construction purposes.

New Water-Power Project to Be Started in Utah

Approval by the state engineer of Utah of the application of the Utah Power & Light Co. for authority to divert 2,500 sec.-ft. and to use a storage of 75,000 acre-ft. on the Bear River in Utah removes the last obstacle in the way of construction of the power company's proposed hydro-electric development on Bear River in Box Elder County, Utah. Work on the new project is expected to begin early in the spring. A combined gravity and arch dam 500 ft. long and 110 ft. high will be built across the river. The power house below the dam will develop a head of 128 ft. in two units of about 20,000 hp. each. The estimated cost of the entire development is approximately $5,500,000.

Reclamation Law Amended by Deficiency Act

Appropriations Also Made for Start of Construction on Four New Enterprises

Part of the recommendations of the Board of Special Advisers on Reclamation which reported last year (*Engineering News-Record*, April 24, 1924, p. 726) has been enacted into law in the shape of a rider on the deficiency appropriation bill passed by Congress last month. This bill also appropriates money for beginning construction on four new reclamation enterprises: The Guernsey reservoir of the North Platte project, $800,000; the Kittitas unit of the Yakima project, $375,000; the Salt Lake Basin project, $375,000; the Owyhee project, Oregon, $315,000; the last two being new projects. However, beginning of construction is contingent on a favorable recommendation on agricultural and engineering feasibility of the projects and reasonableness of the estimated construction costs.

The reclamation law amendment (Sec. IV of the bill) requires that no new project or division shall be undertaken until detailed information has been secured as to water supply, engineering features, cost of construction, land prices, and development costs, and until the Secretary of the Interior shall have made a written finding that it is feasible and that it will probably return its cost to the United States. The irrigable lands in each such project shall be classified as to productivity, and the construction charges assessed against the lands shall be graded accordingly. The construction charges are to be announced when the land is ready for settlement, but public notice that payment is to begin shall not be issued until the agricultural development of the project has advanced sufficiently, but not more than five years from the date of announcement of the charges. Payments on construction charges are to be 5 per cent of average gross production (ten-year average) of the land, and the annual payments shall continue until the total construction charge against each unit is paid. Existing project contracts may be amended to provide for payment of construction charges on the 5 per cent basis, and all payment of construction charges may be deferred for a period of three years. However, in order to come under the amended law, the project or division must assume the operation and maintenance of the project through a water users' association or irrigation district. When operated by the water users, a project will have its construction charge reduced by the profits of project power plants, leasing of grazing and farm lands, Warren Act profits and other income. All overdue charges are to be added to the construction account, as also the current year's operation charges at the time the water users' association takes over operation. On all new projects and new divisions of projects, however, operation and maintenance charges must be paid in advance.

Surveys to determine where construction charges are excessive by reason of reduction in irrigable area below that originally contemplated are authorized; the results, with recommendations, are to be reported to Congress.

Selection of settlers is partly provided for, by a clause authorizing the secretary to require of each applicant for land on a project to show "such qualifications as to industry, experience, character and capital as in his opinion are necessary to give reasonable assurance of success." Boards in part composed of private citizens may be appointed to assist in determining such qualifications.

For general surveys "to determine how arid and semi-arid, swamp and cutover timberlands may best be developed," the sum of $100,000 is appropriated. This section apparently contemplates an extension of reclamation to the eastern half of the country.

Mead and Beach on International Rio Grande Commission

President Coolidge has designated the following special commissioners on the part of the United States to cooperate with representatives of Mexico in a study regarding the equitable use of the waters of the Rio Grande below Fort Quitman, Texas: Dr. Elwood Mead, head of the Reclamation Service, chairman; W. E. Anderson, of La Feria, Texas; and Gen. Lansing H. Beach, U. S. A., retired.

An act of Congress, approved May 13, 1924, provided for the creation of the commission as follows:

"Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the President is hereby authorized to designate three special commissioners to co-operate with representatives of the United States of Mexico in a study regarding the equitable use of the waters of the Rio Grande below Fort Quitman, Tex., with a view to their proper utilization for irrigation and other benficial uses. One of the Commissioners so appointed shall be an engineer experienced in such work. Upon completion of such study the results shall be reported to Congress.

"Sec. 2. The sum of $20,000 is hereby authorized to be appropriated out of any moneys in the Treasury not otherwise appropriated for carrying out the provisions hereof."

The Department of State is communicating with the Mexican Government, through the American Embassy at Mexico City, upon the subject.

Water Consumption at Los Angeles Indicates 100,000 Growth

Based on a 12.5-m.g.d. increase in water consumption at Los Angeles during 1924, and the assumption that the per capita use remained at 125 gal. a day, William Mulholland, chief engineer of water-works, puts the increase of population of that city during the year at 100,000. The same reasoning would make the population 1,215,000 on Dec. 31. A total of 419 miles of mains were laid in 1924, compared with 207 in 1923. New services totaling 20,754 were installed in 1924.

Spanish Springs Reservoir in New Appropriation Bill

An amendment adopted by the Senate Jan. 6 adds $500,000 to the Interior Department appropriation bill for the Spanish Springs extension of the Newlands project in Nevada. This is the much mooted item which caused the failure of the deficiency bill at the last session of Congress. The project was approved by the Bureau of Budget but the item was eliminated by the House Committee on Appropriations. It now goes to conference. Other amendments to the Reclamation Bureau's portion of of the bill, which were approved by the Senate, follow: Operation, maintenance and incidental operations, Williston project $25,000; Echo Reservoir and Weber-Provo Canal, $1,000,000 instead of $900,000.

The Senate struck out the House provisions requiring the payment of interest. It is believed that the House conferees will yield on most, if not all, of the Senate amendments. There is a general disposition to require the participation of the individual states in connection with new projects, but the feeling in the Senate is that this should be brought about in separate legislation and should not be included as a part of an appropriation bill. There was decided objection to legislation of this question until the states themselves had had an opportunity to be heard.

Street Cleaning Conference Held in Chicago

Informal discussions at two round-table meetings constituted the proceedings of the fourth annual conference of the International Association of Street Sanitation Officials, held in Chicago on Jan. 5 and 6. No papers were presented, but the program listed the following subjects for discussion: (1) Snow removal; (2) garbage, ash and rubbish; (3) financial conditions of street cleaning departments; (4) uniform cost keeping system; (5) street cleaning methods and force; (6) sewer and catch basin cleaning; (7) the parking problem; (8) street maintenance.

In cities large and small the parked car prevents systematic street work until after midnight, but at St. Louis the cars left without attendants are hauled three or four blocks away as the street cleaning force advances. There is a general increase in the use of machinery for cleaning snow, but some cities rely almost exclusively on hand labor, since a large employment of industrial labor in the summer results in a large supply of unemployed labor in the winter. In garbage and rubbish removal, the city of Chicago has had very successful results from the use of tractors and trailers, the trailers being taken to central points where the tractors pick them up in trains. In this way a trailer can handle five loads daily, as compared with two loads for a single wagon, while the cost per ton is reduced in the neighborhood of 50 per cent.

The president is W. J. Galligan, Bureau of Streets, Chicago; A. M. Anderson, Chicago, is secretary.

Columbia River Toll Bridge Now in Service

The recently completed toll bridge across the Columbia River at Hood River, Ore., which is the only highway bridge across the Columbia between the toll bridges at Portland, Ore., and Pasco, Wash., a distance of 240 miles, has been opened to traffic and is now in service.

The new bridge is 4,200 ft. long, including approaches, and crosses the river at a point where the width is about 3,200 ft. at low water, with a maximum range in water levels of 53 ft. The crossing is made up of ten steel spans, all of which are of the deck type except the channel through span 262.5 ft. long. The eleven piers range from 80 to 140 ft. in height.

The bridge was privately financed and is owned by the Oregon-Washington Bridge Co., of which the president and treasurer is Elbert M. Chandler of Olympia, formerly acting secretary, American Society of Civil Engineers. The Gilpin Construction Co. of Portland was the contractor and C. B. Wing of Stanford University reviewed the plans for the bankers.

Washington Irrigators Favor Fixed Payments

At a recent meeting of the Washington Irrigation Institute a resolution was adopted opposing the new system of repayment of construction cost on federal reclamation projects, which system provides for variable payments, the annual payment to be five per cent of the gross crop return per year during the preceding 10-year period. The resolution recites that indefiniteness of payments on construction costs is unsound as to both the government and the land owner, and recommends that payments be fixed in amount and be based upon the necessities of each project. The resolution also proposes that no construction payments should be required of the land owner during the first three to five years from the time water is turned upon his land, and that subsequent payments should be based on not less than 15 nor more than 35 years additional time. E. F. Benson, of Tacoma, was chairman of the resolutions committee.

Plan to Divert Hudson Bay Water to Great Lakes Found Feasible

Engineers of the Ontario Hydro-Electric Power Co., after an investigation, have reported favorably as to the feasibility of the proposal to divert the head-waters of the Albany River from the Hudson Bay watershed southward into Lake Nipigon. They estimate that this diversion will increase the flow in the Nipigon River to twice its present amount and that in addition to increasing the output at the present plant at Cameron Falls, it would make possible the development of power at Virgin Falls, Pine Landing, and Camp Alexander.

The estimated cost of the work if diverting the waters of the Albany River is $1,000,000.

Albany Engages Engineer for New Water Supply

The Board of Contract and Supply of Albany, N. Y., has engaged Nicholas S. Hill, Jr., consulting engineer, New York City, to recommend a new source of water supply, to make plans for the necessary works and to serve as engineer of construction. The general expectation is that the supply will be from the highlands. The engagement does not interfere with the improvements of the existing filtration plant and the construction of an additional 10-m.g.d coagulating basin, at an estimated cost of $600,000. This project was noted in *Engineering News-Record* Aug. 2, 1923, as about to be started in accordance with recommendations of Allen Hazen, consulting engineer, New York City, with Mr. Hazen as engineer. The contract for these improvements calls for completion the latter part of the coming summer. The work is now ahead of the schedule.

Purdue to Have Road School

Purdue University announces the eleventh annual road school to be held in Lafayette, Jan. 19-23. Among the more prominent speakers on the week's program are: J. T. Donaghey, chief engineer, Wisconsin Highway Commission; Pyke Johnson, National Automobile Chamber of Commerce; H. F. Clemmer, testing engineer, Illinois State Highway Commission; R. H. Simpson, chief engineer, Department of Public Service, Columbus, Ohio; and from the Indiana State Highway Commission, A. V. Burch, vice-chairman, C. Gray, chief engineer, A. H. Hinkle, superintendent of maintenance, and W. J. Titus, bridge engineer.

Department of Mines Proposed in Oddie Bill Amendment

Legislation intended "to promote the general welfare and to provide all facts needed by Congress in legislating concerning interstate commerce in coal, or needed by the executive departments in discharging their responsibilities touching the coal industry as determined by law, by gathering information respecting the ownership, production, transportation, distribution, sale and use of coal and by publishing the same" has been introduced by Senator Oddie of Nevada, the chairman of the Upper Chamber's Committee on Mines and Mining.

The legislation takes the form of an amendment to Senator Oddie's bill, introduced early in the Sixty-eighth Congress, providing for the establishment of a department of mines, whose head is to be a member of the President's Cabinet.

This measure was prepared in practically its first form, it is understood, during the last session, but the time then seemed inappropriate to introduce it. It is being introduced at this time largely for the purpose of stimulating study and discussion. It is Senator Oddie's thought that some conservative plan should be on record in the event that Congress should decide legislation of this character is necessary.

Random Lines

A Rose By Any Other Name

Some contractors don't want to be called contractors any longer. The unpleasant connotations of the word disturb them—and they are going to revise the language. Instead of using the word that applies to only one part of their function, they would like to use another word that applies to another part of their function. A contractor, we should guess, contracts to construct and constructs that which he contracts for. It's a toss-up which function is the more important, but these gentlemen, in their wish to escape the calumny that attached to the "embalmed beef contractors" of the Spanish War, or to that earlier pyramid "contractor who did Cheops out of several millions," would forego the credit due financial and managerial capability, which is peculiar to them, to emphasize building ability, which they share with many of their engineering brethren. Hereafter, they want to be known as "constructors."

It seems to this column that this is not sufficiently definitive. It does not exclude, as a good definition should, those who are not meant to be included in the term, nor does it cover all those who are. And so we offer to the disturbed gentlemen who want to be re-christened the brand-new word

Constructors

That doesn't mean anything at all, so it can't have odious attachments dragged up from the past; there are no other classes who can lay claim to it, so it is distinctive; and from its very formation it is definitive. What more can they ask? Furthermore it is, as Polonius said, a "vile word" to the ear, a recommendation it shares with its recently coined brothers—"realtor" and "electragist."

* * *

How Many of Us Belong?

A new roof garden at Miami Beach was conceived and carried out by one Carl J. Townsend, *decorative engineer.*

* * *

Horning In

This *human engineer* title has been swiped by preachers, lecturers and lawyers, but the latest one to grab it is an accountant who advertises in *The Nations Business* as follows:

HUMAN ENGINEERING
Railway Audit and Inspection
Company, Inc.
Fourth and Chestnut Streets
PHILADELPHIA

* * *

Better After Than Before

Engineering is the most popular study among the 80 prisoners in Waupun penitentiary who studied under the university extension division this year.
—*Wisconsin Alumni Magazine.*

Engineering Societies

Calendar

Annual Meetings

AMERICAN SOCIETY OF CIVIL ENGINEERS, New York City; Annual Meeting, New York City, Jan. 21-23.

ENGINEERING INSTITUTE OF CANADA, Montreal; Annual Meeting, Montreal, Jan. 27-29, 1925.

AMERICAN WOOD PRESERVERS ASSOCIATION, Chicago, Ill.; Annual Meeting, Chicago, Ill., Feb. 3-5, 1925.

AMERICAN CONCRETE INSTITUTE, Detroit, Mich.; Annual Meeting, Chicago, Ill., Feb. 24-27, 1925.

AMERICAN RAILWAY ENGINEERING ASSOCIATION, Chicago, Ill.; Annual Convention, Chicago, Ill., March 10-12, 1925.

AMERICAN WATER WORKS ASSOCIATION, New York City; Annual Convention, Louisville, Ky., April 27 to May 2, 1925.

AMERICAN SOCIETY FOR TESTING MATERIALS, Philadelphia, Pa.; Annual Meeting, Atlantic City, N. J., June 22-26, 1925.

The American Society for Testing Materials will hold its annual meeting June 22 to 26, at Atlantic City, N. J., with headquarters at the Chalfonte-Haddon Hotel.

The Cornell Society of Engineers (New York) will hold its annual reunion and dinner at the Hotel Pennsylvania, New York City, Jan. 23.

The New York State Association of Builders will hold its 29th annual convention, Jan. 29-30 at the Hotel Lafayette, Buffalo.

The Rocky Mountain Branch of the Associated General Contractors has elected the following officers for 1925: J. Fred Roberts, president; Alex Simpson, vice-president; Francis Kirchhof, treasurer.

Personal Notes

G. E. B. WELLES, who has been engineer of land valuation with the Southern Pacific, has been made valuation engineer for the Pacific System of the company. He will have jurisdiction of all valuation matters except such engineering valuation as is assigned to J. B. MATHEWS, who has been appointed engineer of valuation for the Southern Pacific Co. Mr. Mathews was formerly valuation engineer for the Arizona Eastern Railroad Co. N. D. WOODRUFF, who has been assistant engineer of land valuation, is promoted to engineer of land valuation.

J. FREDERICK JACKSON, former director of the bureau of sanitary engineering of the Connecticut State Department of Health, and chief engineer of the industrial wastes board, is no longer connected with that department. He will devote his entire time henceforth to consultation on matters relating to water supply, sewerage, sewage and garbage disposal, and general sanitation. Mr. Jackson's office is in the Chamber of Commerce Building, New Haven, Conn.

W. A. GLEASON, who has been connected with the engineering department of the port of Seattle for the past six years, has been appointed acting port engineer, and H. W. Davies, former assistant secretary and assistant to the chief engineer, has been named assistant secretary and assistant port engineer. Mr. Gleason's appointment comes as a result of the resignation of GEORGE F. NICHOLSON, chief engineer and executive secretary, who has accepted a position with the Los Angeles Harbor Board.

MAJ. JOHN A. GRIFFIN, formerly city engineer of Los Angeles, Calif., has gone into private practice as consulting engineer with offices at 937 West Seventh Street in that city.

W. G. KNOX, city engineer of Santa Ana, Calif., has resigned, to take effect Feb. 1. His successor will be Nat H. Neff, for three years division engineer of the Orange county road department. Mr. Knox will go into private practice with his former assistant city engineer, R. L. Loucks.

MAJ.-GEN. LANSING H. BEACH, who holds the position of consulting engineer of the Los Angeles (Calif.) Harbor Commission, has been selected to act in a similar capacity for the Orange County Harbor Commission in that state.

Obituary

HENRY H. FARNUM, former engineer of sewers of the Borough of the Bronx, New York City, and one of the founders of Theta Xi, honorary engineering fraternity, died recently in New York City aged 80 years. Mr. Farnum was one of the oldest graduates of Rensselaer Polytechnic Institute, having been graduated from that institution in 1865 at the age of 21 years. After graduation Mr. Farnum went to Colorado to engage in mining work. Returning in 1868 he became assistant engineer for the Port Jervis & Monticello R.R. of New York, then for the New Orleans, Mobile & Chattanooga R.R. and from 1870 to 1875 chief engineer of the South Side R.R. of Long Island. In 1890 Mr. Farnum became associated with what is now the Borough of the Bronx, first as assistant engineer, and then as engineer of sewers. At the time of his retirement two or three years ago he had not only witnessed the phenomenal growth of that borough but had aided materially in its development through his superintendence of engineering installations—having built, among other things, one of the longest and largest sewers in the country.

ERNEST F. BADGER, chemical engineer, Michigan Department of Health, died at Lansing, Dec. 26, 1924, of appendicitis. Mr. Badger graduated from the Massachusetts Institute of Technology in 1895, spending about five years immediately thereafter at the Lawrence Experimental Station of the Massachusetts State Board of Health. For five years more he was with the Rhode Island State Board of Health, after which he was in business in Boston for about twelve years. He was engaged with J. W. Ellms in studies for the purification of the Milwaukee water supply for some time and went to the Michigan Department of Health from that investigation in March, 1920. In Michigan he had charge of stream-pollution work and co-operated as a representative of the Michigan Department of Health with the Department of Conservation on that work. He was also a consultant on water purification and sewage disposal.

JUDSON G. TABLER, county engineer of Bedford County, Virginia, died Dec. 28, 1924, aged 48 years. He began his professional career in 1895 in the Patent Office, Washington, D. C., where he served three years as draftsman. He enlisted in Company F, Third U. S. Volunteer Engineers, and from April to October of the following year was special guard, Q. M. Department, U. S. A., it Cienfuegos, Cuba. Later, Mr. Tabler saw service as resident engineer of construction, Cuba Company Ry., and with the National Rys. of Mexico. Succeeding employment included assistant resident engineer, maintenance-of-way, I. & G. N. R.R., Mart, Texas; principal assistant engineer, Berthe Engineering Co., Charleston, Missouri; junior engineer, Southern Department, U. S. Army. Unsuccessful in his efforts to enter the army in 1917, he was assistant district engineer with the Virginia State Highway Department, and also resident engineer in Roanoke and Salem, resigning in January, 1924. From then until his death he was county engineer of Bedford County.

MINARD L. HOLMAN, until his retirement some time ago as the senior member of Holman & Laird, consulting engineers, St. Louis, Mo., died Jan. 4, age 73 years. Mr. Holman had been ill for several months. He was a former water commissioner of St. Louis. Mr. Holman took his degree at Washington University in 1874; and in 1905 was given an honorary degree of M.A. by that institution. After graduation he was in the office of the supervising architect of the Treasury Department at Washington, D. C., and in 1877 he became assistant superintendent of water-works in St. Louis. In 1887 he was made water commissioner for St. Louis and held that office until 1899. During the five years following he was general superintendent of the Missouri-Edison Electric Co., since absorbed by the Union Electric Light & Power Co. In 1904 Mr. Holman became the senior partner in the firm of Holman & Laird, but retired several years ago from active practice. He was a past-president of the American Society of Mechanical Engineers, having served in that capacity during the year 1908-9. He was also a member of the American Society of Civil Engineers.

HERBERT T. WHITMAN, former Boston surveyor and civil engineer, died at his home at Wollaston, Mass., Jan. 4. Mr. Whitman was born in 1847.

Vol. 94, No. 3

From the Manufacturer's Point of View

A Point of Contact
Between Maker and User of
Construction Equipment and Materials

Improved Equipment at Road Show

Members of American Road Builders Association View Machines and Materials of 287 Manufacturers in Coliseum, Chicago

Engineering News-Record Staff Report

NEW records in number of exhibitors—287 as compared with 232 last year—range of products displayed and amount of floor space occupied were established at the Good Roads Show held in the Coliseum, Chicago, Jan. 5-9, simultaneously with the twenty-second annual convention of the American Road Builders' Association. For the first time this year added exhibition facilities were utilized in the newly completed addition to the Coliseum. Charles M. Upham, state highway engineer of North Carolina, served as general manager of the show.

Among the machines and materials on display were a host of improved features. Before entering into details of the individual exhibits, however, a few general observations may be made as the result of an inspection of the show:

General Trend of Improvements

MANUFACTURERS today, as never before, are introducing refinements of design and construction to insure economical operation, dependability, long life, and increased output. Special importance is being attached to lubrication and bearings as vital elements of machines both large and small. On the larger units, force feed oiling is superseding individual grease cups; roller and ball bearings, and replaceable bronze bushings are more in evidence than in other years; and on the newer machines designs have been altered to give greater accessibility of vital parts for adjustment or replacement.

The construction machine operates under conditions of dust and dirt, and taking these facts into consideration manufacturers are resorting more to the inclosure of gears, shafts and other moving parts, and providing for their operation in oil baths. The severe duty demanded of contractors' equipment is extending the use of alloy steels and special castings. One factor contributing to this development is the increasing power and capacity of the machinery of construction.

The show clearly indicated a wide acceptance of tractor operation, instead of team haulage, for road-building equipment. This trend was shown not only in the number of tractor exhibits, but also in accessory equipment such as graders and snow plows designed especially for tractor operation. With increased mechanical power it has been possible to utilize larger machines and at the show the 12-ft. blade grader was no uncommon sight.

With regard to size and power, however, developments have taken two divergent courses. While many machines have been increased in capacity, there has also been an expansion in the manufacture of the light portable machines as exemplified by the patrol grader, the portable compressor and pump, the ditching machine, the light shovel and crane, and the small tilting concrete mixer on trailer wheels.

Road building, as distinguished from other forms of construction, calls for a great deal of mobile, rather than stationary, plant. As work progresses the machine must move along. Hence we find a wide use of crawler and wheel mountings, making for portability. Transport trailers for moving heavy machines are finding favor. A great many adaptations of the gasoline tractor as the power plant both for operating and moving road-building machinery were in evidence.

Road Show Report in Two Parts

On account of the unusual size of this year's Road Show and the consequent length of the report covering the machines and materials exhibited, space is not available in this issue for the complete story. The first part of the report appears herewith; the concluding portion will be published next week.

As was the case last year, gasoline engines were decidedly in the majority as the power equipment for the machinery displayed. There were units, however, designed for steam-engine or electric-motor operation. In the shovel and crane field this year three manufacturers offered the Diesel engine as the power equipment.

The feature of convertibility was stressed by some makers who showed power shovel, dragline, crane, skimmer scoop, trench hoe, and backfiller attachments for a single machine.

Larger and heavier equipment for snow removal is being provided, particularly in the form of big V-shaped moldboards with extensible side wings behind, giving a spread of 20 ft. and designed for mounting in front of a 10-ton crawler tractor. The ever-increasing importance of traffic regulation was reflected in new machines for painting lines on pavements and for building integral lines into concrete road surfaces. There are also on the market scores of electrically lighted traffic signals and flashing beacons, many of them involving as elaborate design as is called for by railway signaling devices.

Road building and maintenance have opened up a tremendous field for the motor truck. The show included an impressive display not only of trucks but of special forms of end dump bodies and hoisting equipment made especially for the highway builder. On the road trucks manufacturers stressed the two-range transmission feature, one for slow, heavy going and the other for more rapid movement on hard surfaces, short wheel bases for turning in limited areas, and wide tires.

The foregoing notes cover only a few of the general features of the equipment at the show. There follows a more detailed consideration of the individual exhibits, grouped according to general type or purpose of the machine.

* * *

Details of Machines

Graders

APPROXIMATELY 20 different makes of grading equipment including blade graders, subgrading machines, blades for attachment to motor trucks and road scrapers or planes operated by light road rollers or tractors were on display. Among the newer features of the blade machines were quick-lift devices for raising blades to prevent contact with obstructions, steerable engine tongues for tractor operation, stronger frames, and wheels with anti-friction bearings. Blade lengths of 12 ft. are now standard for a number of makes, as are also back sloper attachments for forming ditches at the roadside. For maintenance work there are available a number of light patrol graders with blades 6 ft. long or thereabouts. In addition, manufacturers are producing self-powered graders usually combining machines of the standard blade type with Fordson tractors. Many of these units are mounted on rubber-tired wheels. These power units, as well as the standard graders, are usually equipped with scarifying devices mounted ahead of the blade, in addition to rooter points at the rear end of the machine.

The Austin-Western Co. showed for the first time a new leaning-wheel grader in the form of a tractor-powered machine with rubber tires. A new feature on the company's Aurora grader was a worm-gear control, self-locking, instead of the rack and pinion device formerly used. In addition, the exhibit included machines with 8-ft. and 12-ft. blades, their control being simplified by equalizing spring lifts.

On both its 8-ft. blade grader and 6-ft. patrol machines the Stockland company featured a quick-lift device by

which the entire blade assembly is raised by one lever. New take-up features are provided for all wearing parts to prevent the blade from chattering.

The Western Wheeled Scraper Co. has changed its blade-lifting control from rack and pinion to machine cut worm and gear, eliminating lost motion and providing a self-locking feature for the blade in any position. The scarifier also has been remodeled by providing two rows of steel teeth, one row for operating to depths of 10 to 15 in.

Equalizing-lift springs are now furnished on all of the Adams graders. This company's exhibit included a 12-ft. leaning-wheel machine with improved back-sloper and one piece rear axle on which the frame may be shifted laterally. Roller bearings are available.

On the large Russell super-special grader spring lift blade control and scarifier attachments were features.

Refinements on the Galion grader included roller bearings for the wheels and a new spring equalizer for carrying the weight of the moldboard and simplifying its adjustment. Another refinement was the use of oil-tight housing for the gear control mechanism.

Tractor Graders — The combination grader and tractor outfit with scarifier attachment included the Wehr one-man machine; the Hadfield-Penfield, with one front tilting wheel, rigid rail crawler tracks, and either intermediate or rear end operating platforms; and the Gilbert machine with front end scarifier and also scarifier for use with tractor. These machines, together with the Austin-Western previously noted, were all powered by Fordson tractors. A combination road maintainer, consisting of a 10-ton tractor-operated roller with a 50-hp. gasoline engine, scarifier and blade grader was shown by the Gray Tractor Co.; for oiling moving parts of this machine outside of the motor a pressure oil gun is used. Roller-bearing wheels were a feature of the Northfield patrol grader.

The operations of grading, scarifying and rolling are accomplished in one machine with a 7-ft. blade, the Oswald triple-action road builder, manufactured by the Toledo Road Machinery Co. and equipped with a conveyor for the lateral movement of excavated earth; this machine has a four-wheel drive.

Subgraders and Scrapers

FOR the preparation of road subgrade Lakewood showed a device with cutting blade and scarifying teeth designed to ride on the road form and adapted to widths between 16 and 24 ft. In combination with a Shaw-Enochs tractor, there was exhibited a profile blade for 16-18-ft. road widths; this company also exhibited a blade grader with hinged side wings capable of being folded inward to form a Fresno scraper.

Loading scrapers were shown by two makers. The Baker-Maney machine had an improved pan-dumping mechanism patterned after that used on steam shovel dippers. The Miami trailer-scraper, tractor-operated, was fitted with a new automatic hitch, permitting of disconnection in one minute. For pushing dirt in connection with the making of fills, the Baker company also showed a new bulldozer in the form of a 7-ft. blade attached to the front end of a 5-ton tractor; an automatic lift is a new feature, preventing the blade from striking obstacles.

A detachable blade for mounting underneath a motor truck was shown by Edward J. Jackoboice. Several types of plows for road construction purposes were on display by the Wiard Plow Co.; the largest weighed 310 lb., had a reversible point, and cut a furrow from 10 to 12 in. wide and from 6 to 10 in. deep.

Next Week

The final installment of the Road Show Report, to appear next week, will deal with:

Power Shovels	Cranes
Trench Excavators	Buckets
Gas Engines	Mixers
Compressors	Pumps
Hoists	Forms

Road Rollers

SEVERAL new models of light road roller made their appearance at this year's show. The only new feature on the pioneer Austin "Pup," with Fordson tractor engine, was a new and heavier scarifier. Rollers built around Fordson tractors and weighing from 3 to 4 tons were shown also by the Good Roads Machinery Co. with its "Cub," the Galion Iron Works' "Junior" and Horst & Strieter's Winchell roller. In most cases these light rollers are designed not only for compacting subgrade or fills, but also for operating scarifying and road planing attachments.

In the 10-ton class was the tandem steam roller from the Erie Machine Shops and the three-wheel four-cylinder gasoline roller, equipped with roller bearings and made by the Huber Manufacturing Co.

Snow Plows

HIGHWAY maintenance during recent years has been extended to include a large-scale snow removal program. This trend was reflected in several exhibits of large snow plows designed for operation either by tractors or motor trucks. Particularly impressive were the V-shaped moldboards with extensible side wings on display by the Wausau Iron Works and Monarch Tractors, Inc. The former is designed to roll back the snow and carry it laterally by means of side wings which have a spread of about 20 ft.; this machine is designed for use on the front end of a 10-ton crawler tractor. The Monarch plow, also of the V-shaped type, is equipped on the front end with a pair of three-blade rotary fans driven by a 100-hp. gasoline engine; these fans cast the snow from the moldboard to both sides of the roadway. Each fan is controlled by a separate clutch from the engine; deflecting vanes control the angle of discharge. Represented by photographs at the booth of the La Plante-Choate Co. was another large V-shaped snow plow. The Baker snow plow is in the form of an 8-ft. blade attachable to a motor truck; one of its features is a tripping device of hinged sections to prevent breakage of the blade in case it should strike obstructions.

Another plow of the rotary type was the Snow King made by the Rotary Snow Plow Co.; it consists of a V-shaped moldboard and two laterally revolving rotors, the plow breaking up the snow and delivering it to the rotors and the latter expelling to the sides. Power to operate the rotors is taken from the motor of the propelling vehicle; this plow is made in widths up to 12 ft.

Tractors

A WIDE selection in size and type of tractors was shown by nine makers in addition to two others specializing on crawler attachments for Fordsons. For road building and road maintenance the tractor is now a standard machine, particularly for operating heavy graders. In addition to 2 and 10-ton models, the Holt company showed its new 5-ton caterpillar tread machine, the special feature of which is the three-unit form of construction in which the various parts are grouped into the three main elements of motor, transmission, and roller truck and tracks. This machine has a three-point full spring suspension. Four models of Best tractor were displayed, all of them roller-bearing equipped and provided with spring track tensions, the latter feature insuring automatic release in event of clogging of the treads with mud or snow; the sizes shown ranged from 30 to 60 hp. including both standard and special snow types. A new feature on the 60-hp. tractor is the use of cork seals for making a dustproof inclosure of the roller bearings. At the Bates booth was shown a 25-hp. tractor designed especially for highway maintenance work, and a larger 40-hp. model for heavier construction. Mead-Morrison exhibited a 5-ton, 55-hp. Bear tractor designed for road construction, maintenance and snow removal work.

For heavy construction Monarch Tractors, Inc., showed its 60-hp. model with frame mounted at three points of suspension upon heavy manganese springs. One of the machines was equipped with the big rotary snow plow previously noted. A new highway special, 15-25 hp. tractor, has just been announced by the Cleveland Tractor Co. It is a light machine weighing 3,900 lb., with electric steel track shoes 9½ in. wide; a power pulley take-off is provided at the end of the transmission case. The Shaw-Enochs tractor was of the four-wheel type, the rear wheels being fitted with square rubber pads on curved steel plates bolted to the rims.

For industrial use the International Harvester Co. showed its four-wheel rubber-tired industrial tractor weighing 4,430 lb. and with forward speeds of 2, 4, and 10 miles per hour.

Fordson accessories in the form of crawler attachments were shown by the Belle City Manufacturing Co., handling the Johnson "Trackpull," The Trackson Co., and the Full Crawler Co. The Gray tractor has been noted under the comment on graders.

Industrial Locomotives

SIX manufacturers showed gasoline locomotives for road-material, general construction and industrial haulage. The largest machine was that shown by Fate-Root-Heath, an 18-ton unit powered by a 107-hp., six-cylinder Climax gasoline engine, designed for haulage in quarries, sand pits, brick plants, and heavy railway construction; the company showed also its 8-ton road builders' locomotive with gear drive and four-speed range. Of the Vulcan locomotives, which are equipped with worm gear drive, there was a new 7-ton model of the four-speed selective gear type, the gears being in constant mesh and the transmission case entirely inclosed; this unit is powered by a 60-hp. gas engine. The Whitcomb exhibit included 4 and 8-ton models with ball-bearing equipment, while the Milwaukee locomotive was a 7-ton, four-speed machine, of the gear and chain drive type, with axles operating in roller bearings and journal boxes protected by dustproof housings. Midwest showed a 7-ton four-speed model with gear drive.

A lighter type of machine was that of the Brookville Truck & Tractor Co., which involves the conversion of a Fordson tractor into an industrial locomotive by the substitution of large flanged wheels.

Material Transport

NEW hitches for tractor operation and a sliding hinge bottom for greater mobility in clearing dumped loads were features of the Watson bottom-dump wagon; and on this equipment a positive lock prevents accidental dumping. On the Stroud bottom-dump wagon made by the Little Red Wagon Manufacturing Co. there is an extra heavy arch brace for use under a steam shovel and a compound lever brake operated by foot. The Pekin Wagon Co. featured one of its bottom-dump units.

Batch Boxes—Wooden batch boxes for concrete aggregate were among the products shown by Lakewood, Western Wheeled Scraper, and Koppel. Koppel is now manufacturing a combination narrow-gage car which handles either a V-shaped 40-ft. side dump or two batch boxes. This type of car has double spring suspension and a roller bearing axle mounting.

For transporting heavy construction machinery such as steam shovels from one job to another the Highway Trailer Co. displayed an eight-wheel rubber-tired trailer weighing 5 tons and designed for pull by a 5-ton truck; it has heavy wheels with tires 14 in. wide and is built strong enough to handle a load of 35 tons.

Interchangeability of parts was featured in the exhibit of Sterling wheelbarrows and carts, which are equipped with self-lubricating wheels.

Wheels—For use on Fordson tractors, the Firestone Steel Products Co. showed a line of disk wheels on which the feature was the use at the rim of a thick rubber cushion between the base of the wheel and the steel base of the solid rubber tire. These wheels can be weighted to give greater traction. These cushion wheels were shown with both single and dual tire equipment.

At the French & Hecht exhibit of construction equipment wheels was shown a patent expansible type for solid rubber tires requiring no presses for attachment of tires. The principle involved is that of a split ring and expanding wedge. For Fordson tractors and trailers the Electric Wheel Co. showed rubber tired wheels. Other varieties of construction equipment wheels were shown by the Peru Plow & Wheel Co. and the Lambert "Trubl Pruf" Tire Co.

Motor Trucks

A REPRESENTATIVE group of motor truck manufacturers showed a line of vehicles adapted particularly to road construction and maintenance purposes. The machines were generally equipped with end-dump bodies of various capacities, some of them of the multi-compartment type. One of the outstanding mechanical details was the two-range transmission on a number of trucks giving powerful low haulage for rough or soft ground, and high speed for traveling on hard surfaces. The road-building truck must often turn in restricted spaces and this condition has been met by the design of short-wheel-base models. Both power hoists and hand mechanism were shown for raising and lowering the bodies.

On the front end of one of the Mack trucks was mounted a rotary snow plow. The 3-ton machine of the Four-Wheel Drive Co. was equipped with a Root spring scraper for road maintenance work and also a Champion snow plow of the straight blade type. Another model of the four-wheel drive type was the Oshkosh 2½-3-ton road-building truck. High road clearance and a drive shaft brake were two of the features on the 3-ton Republic model. A two-compartment body with cement container in the tail gate was shown on the United truck. A two-batch end-dump truck was shown by General Motors while Autocar exhibited its new 3-ton end-dump short-wheel-base model with divided compartment body. The 1½-ton Indiana road builder's special had a worm-drive rear axle, while a special three-compartment body of unusually low height to facilitate loading was featured by Graham Bros. Pneumatic tires and short wheel base characterize the Hug speed truck, designed particularly for road construction service. Garford showed a 1½-ton "alley" truck designed for both forward and rear movement at a variety of speeds, six forward and four reverse. Among the heavier trucks was the White 5-ton end-dump model and a chassis carrying a pressure distributor for applying bituminous materials.

Other trucks on display included Sterling, the O'Connell, with a two-way drive feature, the Noble, and the International Harvester.

As an accessory for facilitating motor-truck operation in heavy or soft ground, the Sivyer Steel Casting Co. displayed its Truk-Trak, a crawler tread device and idler to be applied to the rear wheels and disconnected at will.

For handling trucks on road-building jobs, Blaw-Knox showed turntables for both 1½- and 5-ton machines; the larger size takes up a width of only 8 ft. and with a vertical clearance of 12 in. is able to swing over the road forms. Other turntables included the Hug, for wheel bases from 96 to 130 in. and a model of the Freeman turntable.

Truck Hoists and Bodies

END-DUMP bodies with both power and hand hoists were exhibited in sizes upward from 1-ton. Rounded corners, smooth interior surfaces to facilitate discharge of material, and hinged partitions forming separate compartments for sand, stone and cement were among the features of these products. The underbody type of hoist for both light and heavy trucks was shown by the Wood Hydraulic Hoist & Body Co. This system is controlled from the driver's seat and involves an oil-filled cylinder and piston operated by an oil pump of the gear type. The raising and lowering of the body is accomplished by the rolling wedge principle by two sets of flanged steel rollers on the crosshead of the piston rod. On the latest model of this hoist Alemite force feed lubrication is employed for crosshead rollers. The Wood exhibit included also a short-wheel-base road-builder body partitioned for segregating concrete aggregate, with the cement compartment in the middle to insure partial mixing during discharge. The company's vertical type of body hoist also was displayed.

At the Heil booth were improved types of mechanical body hoists with worm gear and pinion drive. All body widths are tapered 3 in. to facilitate load discharge. In addition to a rocker gravity body for a Ford truck, there was shown for a larger truck a steel-lined wood body of 5 yd. capacity with 2-in. oak floor and sides and ⅛-in. steel plate lining designed for steam shovel loading or other conditions of sudden impact. For single batches of concrete aggregate the Lee Trailer & Body Co. exhibited end-dump bodies and trailers, the latter including platform types for moving heavy machines. The bodies shown by the Superior Boiler Works consisted of one piece of sheet steel with rounded corners. On the Anthony rocker dump body for the Ford truck a cast steel rocker has recently been superseded by a formed channel steel rocker.

Other truck bodies at the show included those of Hughes-Keenan, Marion, Hydraulic Hoist, Galion, and Automatic. The Highland company exhibited an inclosed cab for the protection of truck drivers.

To be concluded next week.

Business Side of Construction

FACTS AND EVENTS THAT AFFECT COST AND VOLUME

Increase in Steel Orders Forerunner of Heavy Demand for All Materials in Spring

Lumber Output Indicates Construction Activity—Other Materials Still Under Influence of Seasonal Slow-Down

Steel—The December steel ingot output for the entire country amounted to 3,551,825 tons, a gain of 14 per cent over the month preceding. While the present trend is upward in steel production and demand, the total output for the year 1924 was 36,645,444 tons, against 43,485,665, for the year preceding. In 1924 the high point of production was reached in March, with the low point in July; the high point for 1923 came in May of that year, with the low point in December. Following are the monthly totals, all companies, for the years 1923 and 1924, according to the American Iron and Steel Institute:

	1924 Tons	1923 Tons
Jan	3,633,639	3,841,095
Feb	3,809,185	3,471,843
Mar	4,187,942	4,066,680
Apr	3,333,535	3,963,736
May	2,628,261	4,216,355
June	2,056,466	3,767,256
July	1,869,416	3,531,458
Aug	2,541,501	3,695,788
Sept	2,814,996	3,356,776
Oct	3,111,452	3,577,091
Nov	3,107,226	3,134,321
Dec	3,551,825	2,863,266
Yearly total	36,645,444	43,485,665

The United States Steel Corporation reports unfilled orders amounting to 4,816,676 tons, Dec. 31, 1924, against 4,031,969 tons on Nov. 30, 1924. This represents a gain of 784,707 tons in a month, the heaviest increase in unfilled tonnage, for the month of December, since the inflationary period of 1919.

Lumber—Demand is not so heavy as it was a month ago, or a year ago. Production and shipments for the week ended Jan. 3, were considerably heavier than those for the preceding week or the corresponding period in 1924, according to reports received by the National Lumber Manufacturers' Association from 348 of the largest commercial sawmills of the country.

The following table shows the national lumber movement for the three weeks indicated:

	Week of Jan. 3, 1925 Ft. b.m.	Corresponding Week in 1924 Ft. b.m.	Preceding Week, Dec. 27, 1924 Ft. b.m.
Mills	348	355	352
Production	143,002,588	138,180,288	120,825,095
Shipments	166,042,905	161,693,621	152,423,493
New business	146,401,939	174,624,969	151,060,202

The lumber movement for the entire year 1924, compared with that of the preceding year, is shown as follows:

	Production Ft. b.m.	Shipments Ft. b.m.	Orders Ft. b.m.
1924	12,047,719,353	12,078,410,293	11,963,6+4,454
1923	12,714,834,174	12,642,092,264	12,126,751,317
1924 Decrease	667,114,821	563,681,971	163,136,863

Cement—Final returns of the Geological Survey will probably show total production for the year 1924, at about 148,500,000 bbl., against 137,460,258 bbl. for 1923. It is estimated that the total of 1924 shipments will reach 150,000,000 bbl., compared with 135,912,118 bbl. in 1923. A seasonal decrease in demand has been noticeable since October. At the same time reserve stocks at mills throughout the country, began the accumulation which usually terminates in March of each year.

Brick—Production is now at the highest level ever attained in the history of the industry in this country. This, of course, is taking into consideration the fact that many yards in the northern districts are shut down at this time of the year because of low temperatures. While there are fewer burned or unburned brick on hand at yards than there were a year ago, the commensurate drop in orders and shipments will prevent any unusual shortage in the spring. The following tabulation is compiled from latest reports of the Common Brick Manufacturers' Association of America:

1923	Burned Brick on Hand M.	Unburned Brick on Hand M.	Brick Moved from Yards During Month M.	Orders on Books M.
Dec. 1	334,381	80,643	132,538	276,124
1924				
June 1	223,458	70,802	163,298	394,156
July 1	258,474	72,725	158,753	366,098
Aug. 1	231,182	86,722	149,622	314,588
Sept. 1	261,800	68,138	120,777	256,017
Oct. 1	272,172	61,150	111,846	226,529
Nov. 1	312,061	44,543	135,806	186,977
Dec. 1	319,585	49,596	126,945	179,225

Large Projects In Prospect

The following represent just a few of the big engineering construction jobs on which bids are asked or will soon be called for. Further details are given in the Construction News section of this issue, pp. 25 to 37.

Proposed Work

Streets and sewers, St. Louis, Mo., for Bd. Pub. Serv., $11,598,000.

Electric light improvements and extensions, St. Louis, Mo., for Union Electric Light & Power Co., $11,000,000.

Dams, St. Rose du Degele, Que., for New Brunswick Provincial Government, $4,000,000.

Highway, Ontario, Canada, for Dept. of Provincial Highways, $2,500,000.

Steel mills, Youngstown, O., for Carnegie Steel Co., $2,000,000.

Business and administration building, Cambridge, Mass., for Harvard University, $5,000,000.

Approaches to Vehicular Tunnel, Jersey City, N. J., for State Hy. Com., $5,000,000.

(*Continued on p. 136*)

CONDITIONS OF MATERIALS STOCKS IN IMPORTANT CENTERS

Stocks on hand in approximate figures, example: (Common brick, Denver, 8,000,000); time required for delivery of carload lots to city job, example: (Hollow tile, Atlanta, deliveries take 4 to 5 days); and stocks on hand in general terms, example: (Sewer pipe, Philadelphia, about 100 cars; normal).

	San Francisco	Denver	Detroit	Minneapolis	New Orleans	Atlanta	Philadelphia	New York
Sewer pipe	Stocks in good shape	Dealers' stocks in good condition	Plenty all sizes	Ample	Stocks plentiful	Del. take 4 to 5 days	About 100 cars	Shortages less pronounced at mills
Cement	Dealers' stocks in fair shape	Ample	Reserve stocks accumulating	Sufficient	Normal	About 75 cars	Reserve stocks small	Replenishment of stocks in progress
Limer	Fairly well supplied	Enough	Well supplied by Mich. and Ohio kilns	Adequate	Plentiful	About 60 cars	Enough	Dealers' stocks unusually small
Common brick	Large reserve at yards	8,000,000; normal	Good reserves in local yards	Normal	Sufficient	Plentiful	Abundant	Plenty for present demand
Hollow tile	Ample	Sufficient	Normal; large orders promptly filled	Plentiful	Adequate	Del. take 4 to 5 days	No reserves	Dealers' stocks usually small; prompt del. by rail and water
Lumber	Douglas fir plentiful	Large reserves	Yard stocks about normal	Wholesale and retail yard stocks normal	Fair amount of pine; demand good	Plentiful	Smaller quantity than month ago	Current shipments mostly on old orders
Asphalt	Native product	Plentiful	Well supplied	Ample	.....	About 75 cars	None on hand	Refineries near-by
Structural steel	Mill deliveries slower	Warehouses well supplied	No shortage in local warehouses	Readily obtainable on short order	Plentiful	About 2 cars on sidings	Demand on warehouse stocks small	Mill delivery prompt; buyers avoiding undesirable inventories.

Large Projects In Prospect

(*Concluded from p. 135*)

Paving project, Karnes, Tex., bond election soon, $5,000,000.

Arsenal, Halifax, N. S., bids desired, $2,000,000.

City Hall, Winston-Salem, N. C., bids desired, $1,000,000.

Three Foreign Projects of Interest to Americans

Further information on these three projects may be obtained from the Bureau of Foreign and Domestic Commerce or its district co-operative offices by mentioning the country and reference number given.

An amusement resort to be known as the Crystal Palace is being contemplated, the site for which may be granted to the Canadian Pacific Ry. by the city of Victoria, B. C. The building will be two stories, and the whole top floor and roof will be of glass. It will be 262 x 100 ft. and include a swimming pool and a dance floor. Reference No. 153,259.

A narrow-gage railway is reported planned by a local concern of Chiriqui Province, Panama, to run from Divala to Rabode Puerco, a distance of 16 mi.; gage, 3 ft.; rails 30 lb. per yd. Reference No. 153,195.

Coblenz, Germany, wants new industries. The city plans to develop a tract for industrial convenience. The tract will be graded, wharves built, a railway track laid, a dam put across the Mosel, a canal dug, and cheap electricity provided. Consul, Francis J. Dyer, Coblenz, Germany.

Weekly Construction Market

THIS limited price list is published weekly for the purpose of giving current prices on the principal construction materials, and of noting important price changes on the less important materials. Moreover, only the chief cities are quoted.

Valuable suggestions on costs of work can be had by noting actual biddings as reported in our Construction News section.

The first issue of each month carries complete quotations for all construction materials and for the important cities. The last complete list will be found in the issue of January 1, the next on February 5.

	New York	Atlanta	Dallas	Chicago	Minneapolis	Denver	San Francisco	Seattle	Montreal
Steel Products:									
Structural shapes, 100 lb	$3.34	$3.90	$4.15	$3.10	$3.35	$3.07½	$3.00	$3.35	$4.25
Structural rivets, 100 lb	4.25	4.45	4.75	3.50	3.75	4.65	5.00	3.75	6.00
Reinforcing bars, ¾ in. up, 100 lb	3.24	3.40	3.38	2.60@3.00	3.25	3.97½	3.35	3.25	4.00
Steel pipe, black, 2½ to 6 in. lap, discount	44%	54 2%	43%	56½%	+54 25%	36%	44.7@55 5%	45%	37 83
Cast-iron pipe, 6 in. and over, ton	—54.60@55.60	56.00	56.00	47.20@48.20	—55.50	—62.00	53.00	65.00	60.00
Concreting Material:									
Cement without bags, bbl	2.50@2.60	2.35	2.05	2.10	2.42	2.84	2.31	2.65	1.80
Gravel, ¾ in., cu.yd	2.25	1.90	2.38	3.00	1.65	1.90	2.15	1.50	1.25
Sand, cu.yd	1.25	1.40	2.00	3.00	1.25	1.00	1.50	1.50	1.25
Crushed stone, ¾ in.; cu.yd	1.85	2.00	2.83	3.00	1.75	2.50	2.15	3.00	2.25
Miscellaneous:									
Pine, 3x12 to 12x12, 20 ft. and under, M.ft	—57.00	34.00	56.00	55.00	39.75	39.75	29.00	26.00	60.00
Lime, finishing, hydrated, ton	18.20	22.50	20.00	20.00	23.00	24.00	22.00	24.00	21.00
Lime, common, lump, per bbl	2.50@3.00	1.45	1.85	1.26	1.35	2.70	1.60	2.80	10.50
Common brick, delivered, 1,000	18.00	10.50	11.60	12.00	15.00	12.00	14.50	14.50	17.50
Hollow building tile, 4x12x12, per block	Not used	.1004	.0941	.06	.07	.085	.....	.11	.12
Hollow partition tile 4x12x12, per block	.1162	.1004	.0941	.06	.....	.085	.108	.11	.10
Linseed oil, raw, 5 bbl. lots, gal	1.18	1.26	—1.28	1.25	1.27	+1.40	1.24	1.12	1.11
Common Labor:									
Common labor, union, hour	.75	.30	.....	.82½	.....	.50@.55	.55	.62½	.....
Common labor, non-union, hour	.....	.25	.30@.50	.75	.50@.55	.35@.50	.50	.50	.25@.30

Explanation of Prices—Prices are to contractors in carload lots unless other quantities are specified. Increases or decreases from previous quotations are indicated by + or — signs. For steel pipe, the prevailing discount from list price is given; 45-5% means a discount of 45 and 5 per cent.

New York quotations delivered, except sand, gravel and crushed stone, alongside dock; common lump lime, in 280-lb. bbl. net, and hydrated lime f.o.b. cars; tile "on trucks"; linseed oil and cast-iron pipe f.o.b.

Labor—Concrete laborers' rate, 93⅛c.; building laborers, 75c.; excavating laborers, 62½c. per hr.

Chicago quotes hydrated lime in 50-lb. bags; lump finishing lime per 180-lb. net. Lumber, sand, gravel and stone delivered on job.

Minneapolis quotes on fir instead of pine. Brick, sand and hollow tile delivered. Cement on cars. Gravel and crushed stone quoted at pit. We quote on brown lime per 180-lb. net; white is $1.60 for Kelly Island and Sheboygan. Common labor not organized.

Denver quotes on fir instead of pine. Cement "on tracks"; gravel and sand at pit; stone on cars; lime, brick, hollow tile and lumber on job. Tile price is at warehouse. Linseed oil, delivered in wooden bbl. Common lump lime per 180-lb. net.

Atlanta quotes sand, stone and gravel per ton instead of cu.yd. Common lump lime per 180-lb. net.

Dallas quotes lime per 180-lb. bbl. Steel, cement, cast-iron pipe and crushed stone f.o.b. cars, other materials delivered.

San Francisco quotes on Heath tile, size 5¼ x 8 x 11½. Prices are all f.o.b. warehouses except C. I. pipe, which is mill price plus freight to railway depot at any terminal. Common lump lime per 180-lb. net. Lumber prices are to dealers in yards at San Francisco, for No. 1 fir, common.

Seattle quotes on Douglas fir (delivered) instead of pine. Lump finishing lime per 180-lb. net. Brick and hollow building tile delivered. Hydrated lime in paper sacks. Sand and gravel at bunkers.

Montreal quotes on pine lumber. Sand stone, gravel and lump lime per ton. Stone, lime and tile are delivered; sand, gravel and cement on siding; brick f.o.b. plant; steel and pipe at warehouse. Hollow tile per ft. Cement price is in Canadian funds (the Canadian dollar stands at 99.68). Bag charge is 80c. per bbl. Discount of 10c. per bbl. for payment within 20 days from date of shipment. Steel pipe per 100 ft. net; 2½-in., $37.83.

Conditions Affecting the Market

The price trend is upward, not only in construction materials, but also in the general commodities market.

The excess of advances over declines is not quite so marked as during the past two or three weeks.

Cast-iron pipe is tending downward in the Middle Atlantic States and throughout the West. Wrought-steel pipe is higher in the Great Lakes region, owing to obstruction of navigation by ice. Steel pipe is now coming into this section by rail via Chicago, with consequently higher transportation rates.

Firmness is also noticeable in steel structurals, reinforcing bars, sand, pine lath, red cedar shingles, yellow pine flooring, linseed oil, red and white lead.

Some weakness is noted in lime, gravel, white oak lumber and turpentine. Materials showing greatest stability are: Cement, tile, cut nails, Douglas fir, hemlock, window glass and putty.

A reduction of 10c. per bbl. was recently reported in some of the Mid-Western cement mills. This change has not yet been reflected in the East. This reduction comes at a time when weekly construction reports denote an increasing volume of contract letting.

Reports received by *Engineering News-Record* on building permits issued, show unevenness in the situation, when it is considered that gains are noted in Pennsylvania and Washington, while the opposite condition exists in California and Missouri.

A strike of wire lathers' foremen has been called in New York City. The men demand $75 per week, an advance of $12.75 over the present schedule. This move may result in the precipitation of wage negotiations during the first half of 1925, instead of at a time nearer to Dec. 31, the date of expiration of present contracts.